INSTITUTS SCIENTIFIQUES DE BUITENZORG
„'S LANDS PLANTENTUIN".

TREUBIA

RECUEIL DE TRAVAUX ZOOLOGIQUES, HYDROBIOLOGIQUES ET OCÉANOGRAPHIQUES

RÉDIGÉ PAR

Dr. K. W. DAMMERMAN,
Chef du Musée et du Laboratoire Zoologiques
de Buitenzorg.

VOLUME XIV

1932—1934

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EIN NEUER LORANTHUS-MINIERER,
Phyllocnistis voûtei (LEPID.)

Von

Dr. MARTIN HERING

(Berlin).

Von Herrn Dr. A. D. Voûte-Buitenzorg erhielt ich eine *Phyllocnistis*-Art zugesandt, die von ihm aus *Loranthus*-Minen erzogen wurde, und die sich bei der Untersuchung als eine neue Art herausstellte, die nachfolgend beschrieben und zu Ehren des Entdeckers benannt werden soll. Von *Loranthus* ist bisher erst eine *Phyllocnistis* beschrieben worden, die aber in wesentlichen Punkten verschieden von der neuen Art ist.

Phyllocnistis voûtei sp.nov.

Die neue Art gehört mit *Ph. triploca* Meyr. und *Ph. synglypta* Meyr. zu den wenigen *Phyllocnistis*-Arten, bei denen die silberweisse Grundfarbe durch die dunklen Zeichnungen fast ganz verdrängt und nur noch in schmalen Linien erhalten geblieben ist. Stirn glänzendweiss, Scheitel und Thoraxrücken glänzendgrau. Vorderflügel in der Grundfarbe glänzendweiss, mit einer goldglänzendorangegelben nach aussen keulenförmig erweiterten Mittelstrieme, die gegen Vorder- und Innenrand durch je eine dicke graue Längsstrieme begrenzt wird. Etwas hinter der Flügelmitte befindet sich ein grauer Vorderrandhaken, der alle drei Längsstriemen abschliesst, dahinter liegt eine schmale Querlinie der glänzendweissen Grundfarbe. Am Innenrande liegt eine breite graue Längsstrieme, die aber saumwärts nicht durch die erwähnte schmale silberweisse Linie abgeschlossen wird, sondern bis zur grauen Querbinde geht. Diese breite graue Querbinde geht etwas wurzelwärts schief zum Innenrande und ist kaum ausgebogen. Auf sie folgt wiederum eine schmale Querlinie der silberweissen Grundfarbe. Weiss bleiben in der Wurzelhälfte also nur: Eine schmale weisse Vorderrandstrieme, eine schmale Längslinie auf der Analfalte und schliesslich ein kleiner Fleck am Innenrand unmittelbar vor der grauen Querbinde.

Der grösste Teil der Apicalregion wird von einem etwas glänzenden rötlichbraunen Fleck eingenommen, der wurzelwärts etwas in ein glänzendes Grau übergeht, aber durch eine schmale weisse Linie der Grundfarbe von der grauen Querbinde getrennt wird. Am Apex liegt ein rundlicher tiefschwarzer Fleck. In den Fransen des Vorderrandes befinden sich drei schwärzliche Striche, von denen die ersten beiden vor dem Apikalflecke liegen und nach schräg aussen

gerichtet sind, während das dritte längste senkrecht auf den Spitzenfleck gerichtet ist. Aus diesen strahlen zwei weitere divergierende Striche unterhalb der Spitze aus, darauf folgt schliesslich ein dunkler Strich, der als Fortsetzung des dritten Vorderrandstriches erscheint. Von diesen Strichen ist der erste Vorderrandstrich am kürzesten und undeutlichsten. Saumfransen durch eine schwärzliche Querlinie geteilt, innerhalb derselben glänzend rötlichbraun, gegen den Innenrand aber allmählich in Schwarz übergehend. Aus der weissen Querlinie, die die graue Querbinde saumwärts begrenzt, geht schliesslich ein breiter reinweisser Wisch in die Innenrandfransen. Hinterflügel und ihre Fransen weiss. ♂ Grösse 4—5 mm. Fühler kupferbraun, Körper sonst glänzendweiss, Hinterleib oben grau, Hintertarsen oben mit schwärzlichen Endflecken.

Die neue Art steht am nächsten *Phyll. triploca* MEYR. die bei P u s a ebenfalls von *Loranthus* erzogen wurde. Letztere Art unterscheidet sich von unserer neuen Art in folgenden Punkten: Thorax glänzend weisslich, die graue Innenrandlinie der Vorderflügel wird ebenfalls durch das graue Costalhäkchen abgeschlossen (bei *Ph. voûtei* erst durch die graue Querbinde), der Apikalfleck ist heller, orangegelb, am Apex befinden sich zwei genäherte dunkle Häkchen, also ein sogenanntes Schwänzchen bildend (das Hauptkennzeichen der Art). Da das eingesandte Stück der neuen Art sich in bestem Zustande befand, also die Fransen nicht abgeflogen waren, ist das Fehlen der Apikalhäkchen hier als sicher anzunehmen; im übrigen ist die neue Art auch durch die dunklere Färbung des Apikalfeldes kenntlich. Bei der ebenfalls ähnlichen *Ph. synglypta* MEYR., die im übrigen unserer Art am nächsten steht, deren Futterpflanze noch nicht sichergestellt, wahrscheinlich aber eine *Capparis*-Art ist, fehlt die graue Längsstrieme auf dem Innenrande, während das Apikalfeld ebenso dunkel wie bei unserer neuen Art ist. Sie besitzt ebenfalls keine Häkchen am Apex.

Ph. voûtei wurde erzogen im August 1931 aus unterseitigen Minen an *Loranthus* von Buitenzorg; später wurden auch einige oberseitigen Minen gefunden; die Mine ist wie bei allen *Phyllocnistis*-Arten rein epidermal und stellt einen im Anfang stärker gewundenen, später mehr geraden Gang dar. In seiner Mitte liegt eine auffallende (beim getrockneten Blatt) dunkel violettbraune Kotspur, die 1/3 - 1/2 seiner Breite einnehmen kann. Der Gang liegt vorzugsweise in der Nähe der Mittelrippe des Blattes, erst zuletzt geht die Raupe nach dem Blattrande, wo dann die Verpuppung in einer Erweiterung erfolgt.

ON SOME LEPIDOPTERA FROM THE RIOUW-ARCHIPELAGO

by

R. VAN EECKE

(Museum van Nat. Historie, Leiden).

Dr. K. W. DAMMERMAN, Director of the Zoological Museum at Buitenzorg, Java, has collected in the months June and November 1923 at Doerian, Riouw Arch., some Lepidoptera, of which here is following a list with some remarks.

RHOPALOCERA.

PAPILIONIDAE.

1. **Papilio iswara riouwensis** subsp.nov. On the upperside of the hind wing the two red anal spots with large black centres very well developed. On the underside these anal more orange-red spots larger and the centres smaller with a trace of a third orange-red spot. The blue and bluish green dusty lunules between the red anal spots and the large white discal ones very distinct and paired. On the underside of fore wing the postmedial band of grayish rows very distinct. ♀ Type Mus. Leiden. *P. iswara* also is represented on Billiton.

2. *Papilio memnon agenor* L. One female specimen intermediate between *esperi* BUTL. and *erebinus* HAASE, on the upperside of hind wing without any trace of the anal spot.

3. *Papilio polytes theseus* CRAM. 1 ♂. A large series of this species has been collected by VAN HASSELT on the Riouw-Lingga islands.

4. *Papilio doson evemonides* HONR. ♂ and ♀.

5. *Papilio agamemnon agamemnon* L. 1 ♂.

PIERIDAE.

1. *Terias hecabe locana* FRUHST. 2 ♂♂ and 1 ♀. One male with a wing-expansion of 32 mM.

2. *Catopsilia pyranthe pyranthe* L. 1 ♀. Very common on the Riouw-Lingga and Natoena islands. Mr. A. L. VAN HASSELT has collected a large series of this species in 1895.

DANAIDAE.

1. *Danais melanippus hegesippus* CRAM. 1 ♂. Resembles very much *indicus* FRUHST.

2. *Danais similis vulgaris* BUTL. 1 ♂.

3. *Hestia leuconoë chersonesia* FRUHST. 1 ♀.

4. *Euploea corus phoebus* BUTL. 1 ♀. Already known from Banka, not yet from Riouw. The Banka form has been named *hesiodus* FRUHST.

5. *Euploea aegyptus sophia* MOORE. 4 ♂♂ and 3 ♀♀. Very much resembling *tricolora* FRUHST. and not *dimidius* v. E. from Billiton. Already captured by VAN HASSELT on Riouw.

6. *Euploea mulciber vandeventeri* FORBES. 2 ♂♂ and 1 ♀. Already known from Riouw, Banka and Billiton.

SATYRIDAE.

1. *Ypthima baldus selinuntius* FRUHST. 1♀. Billiton, Natoena- and Riouw Lingga islands, Borneo.
2. *Mycalesis fuscum fuscum* FELD. 3 ♂♂. Banka, Billiton, Riouw-Lingga.
3. *Orsotriaena medus* F.f. *zipoetina* FRUHST. 1 ♂.
4. *Elymnias nigrescens beatrice* FRUHST. 1 ♂.

NYMPHALIDAE.

1. *Cethosia hypsea aeole* MOORE. 1 ♀. On Banka is living a smaller race, *bankana* FRUHST.

2. *Pantoporia asura battakana* FRUHST. 1 ♂. Intermediate between *battakana* FRUHST. from N. Sumatra and *pusilla* FRUHST. from Banka.

3. *Pantoporia nefte subratina* FRUHST. 1 ♀. Also on Banka.

4. *Pandita sinope sinope* MOORE. 2 ♂♂. Not common; unknown from Riouw? Banka, Billiton.

5. *Rahinda hordonia senthes* FRUHST. 1 ♂. More resembling *aigilipa* FRUHST. from Nias!

6. *Rahinda paraka paraka* BUTL. 2 ♂♂. One with a wingexpansion of 32 mm. Banka.

7. *Neptis heliodore siaka* MOORE. 1 ♂. Banka.

8. **Euthalia alpheda dammermani** subsp.nov. ♂ and ♀. The male very dark with very faint traces of the whitish transcellular and subapical lines, resembling more *jama* from Br. India. On the underside of fore wing the postmedial brown band very dark and prominent. The female with large whitish discal patches on the fore wings and with a complete series of arrow-shaped white and dark brown submarginal spots on the hind wings. On the underside the submarginal arrowshaped spots very dark and well developed. This species was already known from Banka (*bankana* FRUHST.) but not yet from Billiton and Riouw.

HESPERIIDAE.

1. *Tagiades gana perakana* FRUHST. 1 ♂. A couple from Billiton is also in the collection of the Leyden Museum. Both localities seem to be new for *gana* MOORE.

2. *Telicota bambusae pythias* MAB. 1 ♂. A second specimen in the Leyden Museum.

3. *Padraona dara moesoides* BUTL. 1 ♂. Not yet known from Riouw?
4. *Parnara contigua* MAB. 1 ♂.
5. *Parnara mathias mencia* LEECH. 1 ♂.
6. *Notocrypta alysos devadatta* FRUHST. 1 ♂.
7. *Hidari irava* MOORE. 1 ♀.

HETEROCERA.

SYNTOMIDAE.

1. *Syntomis huebneri* BSD. 1 ♂. Uncertain, perhaps a new species. Hind wing with only one very small hyaline spot between veins 2 and 5 and fore wing missing the small spot above vein 7 (*frustulenta* SWINH.).

ARCTIIDAE.

Lithosiinae.

1. *Asura lutaroïdes* v. E. 2 ♀♀. Smaller than the specimens from Sumatra.
2. *Chionaema javanica* BUTL. 2 ♂♂.
3. *Ilema decreta* BUTL. 1 ♂.
4. *Bitecta murina* HEYL. 1 ♂.

NYCTEMERIDAE.

1. *Nyctemera baulus* BSD. 1 ♀.

LYMANTRIIDAE.

1. *Dasychira albiplaga* SWINH. 1 ♂.
2. *Leucoma egens* FELD. 1 ♀.
3. *Leucoma divisa* WALK. 1 ♂.
4. *Porthesia bicolor* HEYL. 1 ♀.
5. *Euproctis bimaculata* MOORE. 1 ♂.
6. *Euproctis isabellina* HEYL. 1 ♀.
7. *Euproctis alboscripta* v. E. 1 ♂. Uncertain; a very small specimen.
8. *Euproctis albescens* SWINH. 1 ♀.
9. *Euproctis funeralis* SWINH. 1 ♂.
10. *Euproctis fumosa* SNELL. 1 ♂.
11. *Euproctis micronides* v. E. 1 ♀. Smaller than the type and with a third small black-brown spot in the anal coin of fore wing. Perhaps another species.

LIMACODIDAE.

1. *Setoria simplex* SNELL. 3 ♂♂.
2. *Scopelodes unicolor* WESTW. 1 ♂.

DREPANULIDAE.

1. *Oreta carnea* BUTL. 1 ♂.

THYRIDIDAE.

1. *Striglina strigosa* MOORE. 1 ♂.
2. *Striglina decussata* MOORE. 1 ♂.
3. *Rhodoneura myrtea* DRURY. 1 ♂.

SPHINGIDAE.

1. *Angonyx testacea* WALK. 1 ♂.

NOCTUIDAE.

Acronyctinae.

1. *Ancara obliterans* WALK. 8 ♂♂.
2. *Ancara replicans* WALK. 1 ♂.
3. *Elydna reclusa* WALK. 1 ♂.

Erastrianae.

1. *Flammona quadrifascia* WALK. 2 ♂♂ and 2 ♀♀.
2. *Corgatha aequa* WALK. 1 ♂ (Sec. Miss PROUT).

Eutelianae.

1. *Anuga constricta* GUEN. 2 ♂♂.

Stictopterinae.

1. *Stictoptera describens* WALK. 1 ♂ and 2 ♀♀.
2. *Stictoptera signifera* WALK. 1 ♂ (Sec. Miss PROUT).

Sarrothripinae.

1. *Risoba diversipennis* WALK. 1 ♂.

Acontianae.

1. *Earias flavida* FELD. 1 ♂ and 1 ♀.
2. *Nertobriga signata* WALK. 1 ♂.
3. *Ptyonota formosa* HAMPS. 1 ♂.
4. *Carea vexilla* SWINH. 2 ♂♂.
5. *Carea holophaea* HAMPS. 1 ♀.
6. *Negeta contrariata* WALK. 1 ♀ (Sec. Miss PROUT).

Catocalinae.

1. *Euclidisema mygdon* CRAM. 5 ♂♂.
2. *Mocis frugalis* F. 1 ♂.

Mominae.

1. *Trisuloides opala* PAG. 1 ♀.

Noctuinae.

1. *Ophiusa onelia* GUEN. 2 ♂♂.
2. *Ophideres fullonica* L. 1 ♂ and 2 ♀♀.
3. *Felinia spissa* GUEN. 1 ♂ and 1 ♀.
4. *Hulodes caranea* CRAM. 2 ♂♂.
5. *Tathorynchus vinctale* WALK. 1 ♀.
6. *Rivula* spec. 1 ♂ and 1 ♀.
7. *Loxioda dilutalis* SNELL. 1 ♀ (Sec. Miss PROUT).

Hyblaeinae.

1. *Hyblaea puera* CRAM. 1 ♂.

Hypeninae (named by Miss PROUT).

1. *Bertula moloalis* WALK. 2 ♂♂ and 1 ♀.
2. *Bertula tespisalis* WALK. 1 ♀.
3. *Bertula nigra* SWINH. 1 ♂.
4. *Hydrillodes lentalis* GUEN. ?-1 ♀.
5. *Nodaria externalis* GUEN. 1 ♂.
6. *Poeta quadrinotata* WALK. 1 ♂.
7. ? ? ?.
8. *Progonia patronalis* WALK. 1 ♂.
9. *Simplicia spurialis* SNELL. 1 ♀.

MICRONIDAE.

1. *Urapteroides astheniata* GUEN. 3 ♂♂ and 4 ♀♀.

GEOMETRIDAE.

Hemitheinae.

1. *Dysphania bellonaria* GUEN. 2 ♂♂ and 1 ♀, resembling the specimens from Nias.
2. *Uliocnemis partita* WALK. 2 ♂♂.
3. *Comostola iodioides* LUC. 2 ♀♀ (det. L. B. PROUT).
4. *Chloromachia divapala albisparsa* WALK. 2 ♂♂ (det. L. B. PROUT).

Sterrhinae.

1. *Sterrha phaeocrossa* PROUT. 4 ♂♂ (det. L. B. PROUT).

Boarmiinae.

1. *Plutodes cyclaria* GUEN. 1 ♂.
2. *Nadagara comprensata* WALK. 2 ♂♂ (?!).
3. *Zamarada translucida* MOORE. 2 ♂♂ and 2 ♀♀.
4. *Zamarada cosmiaria* SWINH. 1 ♂.

5. *Orsonoba clelia* CRAM. 1 ♀.
6. *Crocopteryx martiata* GUEN. 1 ♂.
7. *Boarmia acaciaria* BOISD. 1 ♀.
8. *Boarmia inflexaria* SNELL. 2 ♂♂.
9. *Boarmia imbecilis* MOORE. 2 ♂♂.
10. *Boarmia concentraria* SNELL. 1 ♀.
11. *Boarmia* spec.? 1 ♂.
12. *Boarmia spilotaria* SNELL. 1 ♂ and 1 ♀.
13. *Boarmia* spec.? 1 ♂ and 1 ♀.
14. *Boarmia subrugata* WALK. 1 ♂ and 1 ♀ (det. L. B. PROUT).
15. *Tasta sectinota* HAMPS. 1 ♀ (det. L. B. PROUT).
16. *Peratophyga trigonata* WALK. 2 ♀♀ (det. L. B. PROUT).
17. *Ptochophyle dilucida* WARR. 1 ♀ (det. L. B. PROUT).

PYRALIDAE.

Galleriinae.

Three specimens, belonging to two species.

Crambinae.

1. *Culladia admigratella* WALK. 1 ♂.
2. *Ancylolomia chrysographella* KOLL. 1 ♀.
3. *Schoenobius bipunctifer* WALK. 1 ♂.
4. *Cirrochrista fumipalpis* FELD. & ROG. 1 ♀.

Phycitinae.

1. *Nephopteryx* spec.

Epipaschiinae.

1. *Orthaga euadrusalis* MOORE. 2 ♂♂, 1 ♀.
2. *Macalla* (*Epipaschia* spec., near to *validalis* WALK.) 5 ♂♂, 1 ♀.
3. *Stericta* (*Craneophora* spec. near to *haraldusalis* WALK.) 1 ♀.

Chrysauginae.

1. *Endotricha albicilia* HAMPS. 1 ♀.
2. *Endotricha decessalis* WALK. 1 ♀.
3. *Endotricha sondaicalis* SNELL. 1 ♂, 2 ♀♀.

Pyralinae.

1. *Herculia hampsonialis* SNELL. 5 ex.

Hydrocampinae.

1. *Hymenoptychis sordida* ZELL. 9 ♂♂ ♀♀.
2. *Stenia spodinopa* MEYR. 1 ♀.
3. *Aetholix flavibasalis* GUEN. 1 ♂, 2 ♀♀.
4. *Agrotera amathealis* WALK. 1.

Pyraustinae.

1. *Phryganodes analis* SNELL. 1 ♂.
2. *Hoplisa soricalis* SNELL. 1 ♂.
3. *Botys vulgalis* GUEN. 1 ♀.
4. *Sylepta multilinealis* GUEN. 1.
5. *Mabra vagalis* SNELL. 2.
6. *Chloauges glauculalis* GUEN. 2.
7. *Glyphodes hilaralis* WALK. 1.
8. *Glyphodes bivitralis* GUEN. 1.
9. *Dausara talliusalis* HAMPS. 1.
10. *Pyrausta taenialis* SNELL. 4.
11. *Nosophora conjunctalis* WALK. 1 ♂.
12. *Nosophora chironalis* WALK. 1 ♂.

HYPONOMEUTIDAE.

1. *Atteva brucea* MOORE. 2 ♀♀.

XYLORYCTIDAE.

1. *Athrypsiastis symmetra* MEYR. 1 ♂.

ON SOME BIRDS FROM PONTIANAK, DUTCH WEST BORNEO,

by

F. N. CHASEN and C. BODEN KLOSS

(Raffles Museum, Singapore).

The collection of birds here discussed was made under the direction of Mr. L. COOMANS DE RUITER and the Zoological Museum, Buitenzorg at various places in the low country near Pontianak on the west coast of Borneo in March and April 1931.

Although the collection is small and consists largely of common birds it presents several points of interest. The absence of novelties is only to be expected for in the past a number of collections were made, in the neighbourhood of Pontianak and critically examined in Europe. Among the more recent of these may be mentioned that of STORM studied by BLASIUS [1]) and those of various collectors reported on by BÜTTIKOFER [2]). Inland from Pontianak the country about the upper Kapoeas River has of course been studied in considerable detail by BÜTTIKOFER (1900) and FINSCH (1905).

As previous ornithological work on the district was done in the binomial era we have examined the birds before us mainly with a view to subspecific determination. It is at once evident that the affinity between Pontianak and the territory of British North Borneo is remote — a number of species being represented by different races in the two areas. The avifauna of Sarawak roughly west of the Baram River also differs from that of north Borneo in important respects. No modern ornithologist seems to have studied a comprehensive collection from southern most Borneo: from a study of a few species we know that these two areas sometimes show subspecific differences. The presence of *Cyanoderma erythroptera rufa* at Pontianak may indicate that the lowlands of the west coast should be grouped with south rather than with northwest Borneo.

It is curious that certain birds common throughout the greater part of Borneo seem to be absent, or very rare in the lowland forests of the north-eastern part of the island. For instance, the present collection contains examples of *Melanoperdix nigra borneensis, Houppifer erythrophthalmus pyronotus, Chotorhea rafflesii borneensis, Setornis criniger* and *Dicaeum c. chrysorrheum;* but

[1]) "Vögel von Pontianak (West Borneo) und anderen Gegenden des indomalayischen Gebietes", Mitt. d. Geogr. Ges. u. des Naturh. Museums zu Lübeck. 11. Reihe, 1896, Heft X, pp. 122 (Pontianak portion).

[2]) "Zoological Results of the Dutch Scientific Expedition to Central Borneo", Birds, Notes Leyden Mus. XXI, 1900, pp. 145—289.

although these are common in Sarawak (*Chotorhea rafflesii* is very common) they were not represented in the large collection made by us near Sandakan in 1927: furthermore they do not seem to have been obtained by GRAYDON who collected at Lamag on the Kinabatangan River, ADAMS who collected from Sandakan round the east coast to Darvel Bay, PRYER whose specimens mostly came for the immediate vicinity of Sandakan or GUILLEMARD when at Darvel Bay.

For the privilege of examining the present collection we are indebted to Dr. K. W. DAMMERMAN of the Zoological Museum, Buitenzorg. In view of the extensive material we have seen from other parts of Borneo [1]) (except the south) the opportunity of studying birds from Pontianak was particularly welcome.

PHASIANIDAE.

Excalfactoria chinensis lineata (SCOP.).

1 ♂. Wing, 71 mm.

Melanoperdix nigra borneensis ROTHS.

2 ♂, 1 ♀. Wings, ♂ 140, 145; ♀ 135 mm.

We have now seen fair series of this partridge and do not think that the males of *nigra* from the Malay States and Borneo can be separated on colour. Females from Mt. Poi and the Baram district in Sarawak and from Mt. Kinabalu in North Borneo are more rufous below than most Malayan birds, but occasional specimens of the latter are also deeply coloured and very like the Bornean race: the female of *borneensis* is also usually darker and more richly coloured above than the same sex of *nigra* in the Malay Peninsula.

Houppifer erythrophthalmus pyronotus (GRAY).

1 ♂. Wing, 231 mm.

CHARADRIIDAE.

Capella stenura (KUHL).

1 ♂. Wing, 135 mm.

ARDEIDAE.

Butorides striatus javanicus (HORSF.).

1 ♂, 1 ♀. Wings, ♂ 177; ♀ 170 mm.

Egretta garzetta garzetta (LINN.).

1 ♂. Wing, 265 - 270 mm.

FALCONIDAE.

Cuncuma leucogaster leucogaster (GM.).

1 ad., 1 imm.

Microhierax fringillarius (DRAP.).

2 ♂. Wings, 95, 96 mm.

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[1]) See CHASEN & KLOSS, Bull. Raffles Mus., 4, 1930, pp. 1—124 and KLOSS, Treubia, XII, livr. 3—4, 1930, pp. 395—424.

PSITTACIDAE.

Coryllis galgulus galgulus (LINN.).

1 ♂. Wing, 80 mm.

CORACIIDAE.

Eurystomus orientalis orientalis (LINN.).

1 ♂. Wing, 179 mm.

ALCEDINIDAE.

Ramphalcyon capensis javana (BODD.).

1 ♂, 2 ♀. Wings, ♂ 140, 135; ♀ 150 mm.

Alcedo meninting verreauxi DE LA BERGE.

2 ♂, 1 ♀. Wings, ♂ 62, 63; ♀ 64 mm.

Alcedo atthis bengalensis (GM.).

2 ♂. Wings, 68, 71 mm.

BUCEROTIDAE.

Anorrhinus galeritus (TEMM.).

1 ♂. Wing, 320 mm. (c.).

MEROPIDAE.

Merops viridis viridis LINN.

1 ♂. Wing, 114 mm.

Merops superciliosus javanicus HORSF.

1 ♂, 1 ♀. Wings, ♂ 132; ♀ 122 mm.

CAPRIMULGIDAE.

Caprimulgus macrurus macrurus HORSF.

1 ♀. Wing, 181 mm.

Caprimulgus indicus jotaka TEMM. & SCHLEG.

1 ♀. Wing, 207 mm.

TROGONIDAE.

Pyrotrogon diardi diardi (TEMM.).

1 ♀. Wing, 147 mm.

Pyrotrogon fasciatus impavidus CHAS. & KLOSS.

1 ♂ imm. Wing, 140 mm.

This recently described race (Bull. Raffles Mus. 5, 1931, p. 84) is like *P. f. kasumba* of Sumatra, but smaller.

CUCULIDAE.

Surniculus lugubris brachyurus STRES.

1 ♂, 1 ♀. Wings, ♂ 120; ♀ 120 mm.

Cuculus micropterus concretus S. MÜLL.

1 ♂. Wing, 170 mm.

Rhopodytes sumatranus (RAFFLES).

1 ♂. Wing, 140 mm.

Rhinortha chlorophaea chlorophaea (RAFFLES).

2 ♂, 2 ♀. Wings, ♂ 113, 114 mm.

Phoenicophaus curvirostris borneensis (BLAS. & NEHR.).

1 ♂. Wing, 166 mm.

Centropus bengalensis javanensis (DUM.).

1 ♂. Wing, 141 mm.

CAPITONIDAE.

Chotorhea mystacophanes humei (C. & G. MARSHALL).

Megalaema humei C. & G. Marshall, Ibis, 1870, p. 536: Sarawak.

1 ♀. Wing, 98 mm.

This is a "thin" race but in series Bornean birds have the red of the throat deeper in colour than those from Sumatra and the Malay Peninsula: they also, usually, have the blue spot on the side of the head mixed with black. Individuals of the two races are sometimes not separable.

Chotorhea rafflesii borneensis BLAS.

Chotorhea versicolor v.n. *borneensis* Blasius, Verh. z.-b. Ges. Wien, 33, 1883, p. 25: southeast Borneo.

4 ♂, 1 ♀. Wings, ♂ 122, 116, 120; ♀ 118 mm.

The Bornean race is very thin and stands on the average character of a less intensely blue throat.

Mesobucco duvauceli duvauceli (LESS.).

1 ♂. Wing, 72 mm.

PICIDAE.

Picus puniceus observandus (HART.).

1 ♂, 1 ♀. Wings, ♂ 116; ♀ 117 mm.

Callolophus miniatus dayak STRES.

1 ♀. Wing, 120 mm.

Chrysophlegma mentale humei HARG.

1 ♂. Wing, 136 mm.

Dryobates moluccensis moluccensis (GM.).

1 ♀ imm. Wing, 70 mm.

Meiglyptes tristis micropterus HESSE.

2 ♀. Wing, 93 mm. (1).

Meiglyptes tukki tukki (LESS.).

1 ♀. Wing, 98 mm.

Micropternus brachyurus badiosus (TEMM.).

3 ♂. Wings, 109, 114, 117 mm.

Dinopium javanensis borneonensis (DUBOIS).
1 ♀. Wing, 125 mm.
Dryocopus javensis javensis (HORSF.).
1 ♀. Wing, 229 mm.
Sasia abnormis abnormis (TEMM.).
1 ♀. Wing, 55 mm.

EURYLAIMIDAE.

Calyptomena viridis viridis RAFFLES.
1 ♂. Wing, 97 mm.
Eurylaimus ochromalus kalamantan ROB. & KLOSS.
2 ♂. Wings, 80, 80 mm.
Cymborhynchus macrorhynchus macrorhynchus (GM.).
1 ♂, 1 ♀. Wings, ♂ 103; ♀ 101 mm.
Corydon sumatranus brunnescens HART.
1 ♂, 1 ♀. Wings, ♂ 130; ♀ 131 mm.

PITTIDAE.

Pitta brachyura cyanoptera TEMM.
1 ♂. Wing, 120 mm.
Pitta sordida muelleri BP.
1 ♂, 2 ♀. Wings, ♂ 111; ♀ 106, 108 mm.

MUSCICAPIDAE.

Cyornis turcosa rupatensis OBERH.
1 ♀. Wing, 74 mm.
Rhipidura perlata S. MÜLL.
1 ♀. Wing, 77 mm.
Terpsiphone paradisi borneensis (HART.).
2 ♂, 1 ♀. Wings, ♂ 93, 95; ♀ 84 mm.
Drymophila pyrrhoptera pyrrhoptera (TEMM.).
1 ♂. Wing, 85 mm.
Rhinomyias umbratilis umbratilis (STRICK.).
1 ♀. Wing, 72 mm.

CAMPEPHAGIDAE.

Pericrocotus flammeus xanthogaster (RAFFLES).
1 ♂. Wing, 81 mm.

PYCNONOTIDAE.

Aegithina tiphia damicra OBERH.
1 ♀. Wing, 56 mm.
Erratum. — Treubia, XII, 1930, p. 411, line 13 for "*Ae. t. tiphia*" read "*Ae. t. viridis*" (C. B. K.).
Irena puella criniger SHARPE.
1 ♂, 1 ♀. Wings, ♂ 114; ♀ 120 mm.

Tricholestes criniger viridis (BP.).

1 ♂. Wing, 75 mm.

Setornis criniger LESS.

1 ♂. Wing, 100 mm.

Pycnonotus plumosus subsp.

1 ♀. Wing, 81 mm.

Series of fresh skins are required before the bird inhabiting western Sarawak and Dutch west Borneo can be finally allocated to a subspecies. The specimen before us is more like typical *plumosus* than *insularis* CHAS. and KLOSS, of north Borneo.

Pycnonotus brunneus brunneus BLYTH.

1 ♀. Wing, 77 mm.

TIMALIIDAE.

Pomatorhinus montanus borneensis CAB.

1 ♂, 1 ♀. Wings, ♂ 82; ♀ 80 mm.

Malacocincla sepiaria rufiventris SALVAD.

1 ♂. Wing, 76 mm.

Anuropsis malaccensis saturatus ROB. & KLOSS.

1 ♂. Wing, 68 mm.

Aethostoma rostrata macroptera (SALVAD.).

2 ♂. Wings, 72, 74 mm.

Malacopteron cinereum cinereum EYTON.

1 ♂. Wing, 78 mm.

Stachyris nigricollis nigricollis (TEMM.).

1 ♂. Wing, 74 mm.

Mixornis gularis borneensis BP.

1 ♀.

Cyanoderma erythroptera rufa CHAS. & KLOSS.

1 ♂, 1 ♀. Wings, ♂ 60; ♀ 57 mm.

These specimens are much redder above and duller on the posterior lower parts than *C. e. bicolor* of North Borneo: they lack the rufous nape of the type of *rufa* but this may be an individual character of the latter. *C. e. rufa* (Sampit, south coast of Borneo) and *C. e. apega* OBERH. (Banka and ? Billiton) seem to need an exact comparison.

SYLVIIDAE.

Orthotomus atrogularis atrogularis (TEMM.).

1 ♂. Wing, 44 mm.

The throat more solidly black than in any other specimen of this race before us. ROBINSON had called our attention to the fact that Bornean males were "all infinitely blacker on the throats than Malayan birds" but we have never seen enough material from Borneo to decide the question for ourselves.

LANIIDAE.

Hemipus hirundinaceus (TEMM.).

1 ♀. Wing, 64 mm.

Platylophus galericulatus coronatus (RAFFLES).

1 ♂. Wing, 131 mm.

CORVIDAE.

Corvus enca compilator RICHM.

2 ♂. Wings, 325 mm. (1).

Platysmurus leucopterus aterrimus (TEMM.).

1 ♂, 1 ♀. Wings, ♂ 190; ♀ 192 mm.

DICRURIDAE.

Dissemurus paradiseus brachyphorus (BP.).

1 ♀, 3 juv. Wing, ad. 139 mm.

ORIOLIDAE.

Oriolus xanthonotus xanthonotus HORSF.

1 ♂. Wing, 102 mm.

NECTARINIIDAE.

Chalcostetha calcostetha calcostetha (JARD.).

6 ♂. Wings, adults 60.5, 62.5 mm.

Aethopyga siparaja siparaja (RAFFLES).

2 ♂. Wings, 50, 51 mm.

Leptocoma jugularis pectoralis (HORSF.).

1 ♂, 1 ♀. Wings, ♂ 52; ♀ 48 mm.

HORSFIELD's name is available for this race (*L. j. ornata* KLOSS, Treubia, XII, 1930, p. 422) in the genus *Leptocoma.*

Arachnothera longirostra buttikoferi VAN OORT.

1 ♀. Wing, 60 mm.

Arachnothera affinis modesta (EYTON).

1 ♀. Wing, 84 mm.

DICAEIDAE [1]).

Dicaeum chrysorrheum chrysorrheum TEMM.

1 ♂. Wing, 59 mm.

Dicaeum trigonostigma dayakana CHAS. & KLOSS.

3 ♂. Wing, ad. 45 mm.

Rather pale on the throat but not *D. t. trigonostigma.*

Prionochilus percussus ignicapillus (EYTON).

1 ♂. Wing, 55 mm.

[1]) Erratum. — Treubia, XII, livr. 3—4, 1930, p.423, line 27 for "the typical form" read "*ignitum* Begbie of the Malay States" (C.B.K.).

The rediscovery of this species in Borneo is an interesting event confirming BÜTTIKOFER's record from the headwaters of the Kapoeas River (see CHASEN and KLOSS, Bull. Raffles Mus., 4, 1930, p. 111).

Prionochilus maculatus maculatus (TEMM.).

3 ♂, 1 ♀. Wings, ad. ♂ 51, 51 mm.

CHALCOPARIIDAE.

Chalcoparia singalensis subsp.

3 ♂. Wings, 53, 54, 55 mm.

These west Bornean birds are comparatively pale on the throat and breast and only very doubtfully separable from typical *singalensis* of the Malay States.

NOTES ON *MAGALOPLASTINX CARINIFRONS* SCHMIDT.

(Tettigometridae, Fulgoroidea).

By

the late F. MUIR.

This genus contains but the one species which was described in 1912 from specimens from Sumatra. I have one male from Mount Salak, Java (April 1922) and one female and one young from Parakansalak, Java (August 1919) collected by L. KALSHOVEN, which I consider to be the same species.

The taxonomy of this small but interesting family is very unsatisfactory. BAKER's [1]) division of it into three subfamilies, based upon the relative

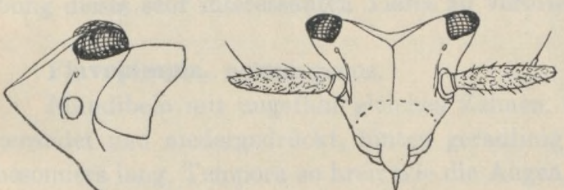

Fig. 1. — *Magaloplastinx carinifrons* SCHMIDT. Adult. Profile view of head (left), and full view of frons (right).

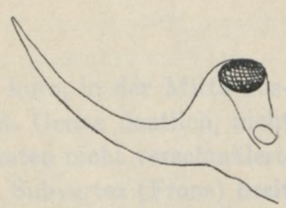

Fig. 2. — *Magaloplastinx carinifrons* SCHMIDT. Young. Profile view of head.

length and width of the head, is neither natural nor convenient. A better arrangement of the genera would be upon the condition of the male genital styles. In this genus, along with *Egropa* and *Tettigometra*, the males have well developed genital styles with apodemes, whereas *Euphyonartex, Hilda* and *Nototettigometra* have no male genital styles, or only membraneous lobes. It is unfortunate that we do not know the conditions of the male genitalia of some genera.

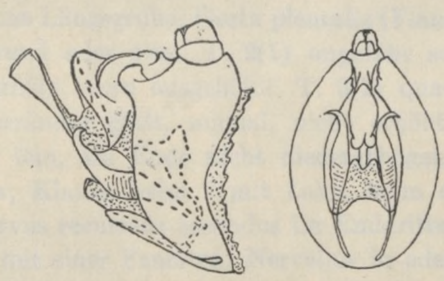

Fig. 3. — *Magaloplastinx carinifrons* SCHMIDT. Lateral (left) and full view of male genitalia.

This genus has the genital styles well developed; the other details are best understood from the figures.

The chief characteristic of the head of this genus is the formation of a tetrahedron by the meeting of the angular vertex and the frons, the frons in profile being in line with the clypeus. In the young this is produced into a long, pointed process, curved upward, a condition found in the young of *Egropa*.

[1]) Philippine Journ. Sci. 24 (1). 1924, p.92.

In the young the hind basitarsus is fairly short and thick, the apex rounded and without spines; the second tarsus is short and stout, the apex rounded and without spines. In the adult the basitarsus is longer, the apex slightly widened, truncate, with about ten equal spines; the second tarsus is short, the apex subtruncate with a spine on each side. As the nature of the hind tarsi are of value in the grouping of the families of the *Fulgoroidea* it is necessary to have more detailed information of their condition in different genera, both in the young and adult.

EINE NEUE AUS MANGA-FRÜCHTEN GEZÜCHTETE PIMPLINE (Fam. ICHNEUMONIDAE).

Von

Dr. J. G. BETREM

(Malang).

Der Freundlichkeit des Herrn Dr. A. D. Voûte, früher Entomolog am Institut für Pflanzenkrankheiten verdanke ich einige Exemplare des hier zu beschreibenden Insekts, welche mir zur Bestimmung überlassen wurden.

Gerne habe ich dem Wunsch von Dr. Voûte entsprochen eine Neubeschreibung dieses sehr interessanten Tieres zu veröffentlichen.

Flavopimpla, novum genus.

Mandibeln mit ungefähr gleichen Zähnen. Clypeus kurz, in der Mitte ausgerandet und niedergedrückt, hinten geradlinig begrenzt. Genae deutlich, nicht besonders lang. Tempora so breit wie die Augen, nach hinten nicht verschmälert. Vertex hinten deutlich eingedrückt, nicht ausgeschnitten. Subvertex (Frons) breit und kurz, nicht eingedrückt; Scrobi gross nur sehr schwach angedeutet. Scapus aussen tief ausgeschnitten. Notauli nur vorn angedeutet, fast fehlend; die Seitenleisten des Mesoscutums die Praescutellargrube erreichend jedoch sich nicht auf die Praescutellarleisten fortsetzend. Scutellum nicht gerandet. Epomien der Mesopleuren nur bis an die sehr flache Grube unter der Flügelschwiele reichend. Sternauli ganz fehlend. Mediansegment flach, nicht bucklig, fast von der Basis an abschüssig, ganz glatt, ohne Carinae und ohne Längsgrube; Costa pleuralis (Flankenleiste) vollständig; Spiraculae klein, rund oder oval. T. 2(1) ungefähr so lang wie breit, hinten nicht tafelförmig erhöht, vorn ausgehöhlt. T. 3(2) quadratisch; folgende Segmente quer; Hinterränder glatt, schmal, nicht erhöht. Terebra so lang wie der Körper; Bohrer fein, am Ende nicht niedergebogen, gerade. Beine nicht schlank; Sporen kurz; Klauen beim ♀ mit Zahn, beim ♂ ohne Zahn. Flügel mit Areola, die den Nervus recurrens secundus im Enddrittel aufnehmt, dieser stark auswärts gebogen, mit einer Fenestra; Nervellus in oder über der Mitte gebrochen.

Dieses neue Genus unterscheidet sich in den folgenden Punkten von den verwandten Genera: Bei *CALLIEPHIALTES* Ashm. 1901 ist der Nervellus in oder unter der Mitte gebrochen (bei *C. odinae* über der Mitte); die Stigmata des Mediansegmentes sind rund; das Segment 3(2) ist immer deutlich länger wie breit. Cushman kennt die typische Art dieses Genus. Dieser Autor hat leider nirgends eine Beschreibung gegeben. Aus den Beschreibungen anderer neuerer

Arten (4, 5) geht jedoch hervor, dass die Notauli vorn tief eingedrückt sind, dass das Praescutum deutlich ist, dass die Genae sehr kurz sind und dass der Kopf nach hinten verschmälert ist. Da diese Merkmale Artbeschreibungen entnommen sind, sind sie mit Vorsicht zu gebrauchen.

Dieses Genus kann also unterschieden werden durch die deutlicheren Notauli, das längere T. 3(2), die nicht grossenteils gelbe Farbe und durch andere Merkmale. Vermutlich gibt es noch mehrere Unterschiede, leider sind die Beschreibungen ungenügend. Dass dieses Genus unterschieden werden kann von *Ichneumon* L. (*Ephialtes* auct.) geht aus der Tatsache hervor, dass CUSHMAN unter diesem Genusnamen Arten beschreibt.

Da *Calliephialtes odinae* einen Nervellus hat, der über der Mitte gebrochen ist, besteht zufolge der ursprünglichen Beschreibung ASHMEADS, nur noch ein einziges Merkmal, wonach dieses Genus von *Ichneumon* (*Ephialtes*) unterschieden worden kann, nl. die runden Luftlöcher des Mediansegmentes, welches Merkmal zur Trennung dieser zwei Genera nicht genügt. Auch durch den nach hinten verschmälerten Kopf lässt *Calliephialtes* nicht mit Sicherheit von *Ichneumon* unterscheiden. In der übrigen mir bekannten Literatur sind bis jetzt keine weiteren Unterschiede publizirt. Hoffentlich wird es nicht lange dauern bis Herr CUSHMAN die Unterschiede in seiner bekannten gründlichen Weise angeben wird [1]).

ICHNEUMON L. (= *EPHIALTES* auct.). Nach SCHMIEDEKNECHT (11, p. 1112) ist dieses Genus durch die folgenden Merkmale zu erkennen: Mesonotum dreilappig, also Notauli deutlich; Mediansegment meist runzlich mit zwei Längskielen, zwischen diesen vertieft; Area posteromedia klein und unvollständig; das 2. Segment stets länger wie breit. In der schwedischen Beschreibung THOMSONS (12, p. 737) dieses Genus werden noch folgende Merkmale hervorgehoben: mittleren Hinterleibstergite mit breiten, oft quergestreiften Hinterrändern; Terebra an der Spitze dicker und etwas niedergebogen. Auf p. 1408 führt THOMSON ebenfalls das bucklige Mediansegment als Merkmal an. Die Beschreibungen MORLEYS geben keine neue Merkmale, jedoch gibt er in seiner Übersetzung THOMSONS folgendes an (p. 178): "The terebra is not deflexed and is thicker than in Pimpla". Diese Übersetzung stimmt also nicht mit dem ursprünglichen Text überein.

EXERISTES [2]) steht *Ichneumon* so nahe, dass THOMSON die typische Art dieses Genus unter *Ephialtes* aufnahm (13, p. 1408). Ebenso wenig kann MORLEY dieses Genus gut von *Ichneumon* unterscheiden (9, p. 24). Die Merkmale durch welche dieses Genus von *Flavopimpla* unterscheiden werden kann, sind zufolge THOMSON (13, p. 1408) und HOLMGREN (7, p. 25), wenn man die typische Art

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[1]) Die europäische Art *Ephialtes messor* GRAV. 1829 scheint auch zum Genus *Calliephialtes* zu gehören. Die Biologie dieser Art ist beschrieben von CUSHMAN im Journal Agricultural Research I, p.211—237, Washington D.C. 1914.

[2]) Die Bestimmungstabelle der indischen Genera MORLEY's (8, p.83—85) gibt für die *Exeristes*-Arten einen über der Mitte gebrochenen Nervellus an. Seine meisten indische Arten jedoch haben einen unter der Mitte gebrochenen Nervellus. Einige dieser gehören sicherlich nicht zu diesem Genus.

E. roborator betrachtet, die feine, an der Spitze niedergebogene Terebra und das bucklige, deutlich punktierte Mediansegment.

Pimpla roborator Grav. 1829, welche Art durch Schmiedeknecht als Genotype des Genus *Exeristes* gewählt wurde, kann nach meiner Meinung nicht die typische Art sein, weil Förster ausdrücklich angibt: "Bohrer an der Spitze gerade" während doch bei *P. roborator* Grav. die Spitze des Bohrers abwärts gekrümmt ist (vergl. 13. Thomson p. 1408). Vielleicht ist es wahrscheinlicher, dass Förster dieses Genus für Arten des Genus *Scambus* (*Epiurus*) mit ovalen Luftlöchern aufgestellt hat. Es ist also besser den Namen *Exeristes* nicht mehr zu verwenden, da dieses Genus doch nicht mit Sicherheit zu deuten ist.

Ob *Coccygomimus* Sauss. an die Stelle von *Exeristes* treten kann, kommt uns sehr fraglich vor; gibt doch Schmiedeknecht für *Exeristes* in seinen Opuscula p. 1018, wonach Schulze (16, p. 23) verweist, das folgende an: "Augen bei ♀ und ♂ tief ausgebuchtet", was ein Druckfehler ist, da Förster schreibt "kaum ausgerandet". Zu meinem Bedauern stehen weder die Saussure'sche Arbeit (15), noch die Publikation Tosquinets (14), in welchen beiden Werken die Genotype des Genus *Coccygomimus* beschrieben wird, zu meiner Verfügung.

CHARITOPIMPLA Cam. 1902. Sicher ist dieses Genus nicht, wie Morley angibt, synonym mit *Exeristes*. Es ist mit dem Genus *Philopsyche* Cam. 1905 identisch. Die sehr gemeine australische Art dieses letzten Genus *P. pilosella* Cam. 1911 hat Morley in 1914 aufs neue als *Exeristes consimilis* beschrieben. Der ursprünglichen Beschreibung nach hat *Charitopimpla* einfache Klauen. Diese Angabe beruht zweifellos auf einem Irrtum. *Charitopimpla* unterscheidet sich von *Flavopimpla* durch deutlicher ausgerandeten Augen, den hinten stark verschmälerten Kopf, die fehlenden Genae und durch andere Merkmale.

SCAMBUS Hrtg. 1838 incl. *Epiurus*. Wahrscheinlich ist dieses Genus am nächsten mit dem neuen Genus verwandt, es hat jedoch deutliche Notauli und kein glattes Mediansegment.

Die karakteristischen Merkmale des neuen Genus sind also: die grossenteils gelbe Farbe, die nur angedeuteten Notauli, die die Scutellargruben erreichenden Seitenränder des Mesoscutums, das glatte, nicht punktierte, nicht bucklige Mediansegment, das von der Basis ab abschüssig ist und oben keine Längsgrube oder Carina hat, das quadratische Segment 3(2) und der am Ende gerade körperlange Bohrer.

Dieses Genus gehört zu dem Tribus der *Ichneumonini* Cushm. et Rohwer 1920. Da nicht alle Merkmale dieses Genus typisch sind, ist es ein wenig schwierig nach der Tabelle von Cushman & Rohwer auf diesen Tribus zu kommen. So ist die krenelierte Furche der Punktgrube gegenüber nur wenig eckig, während auch die Notauli beim ♀ nur angedeutet sind.

Der nicht dicht auf dem Thorax sitzende Kopf, der bogenförmige Nervus recurrens secundus und der ausgerandete Clypeus zeigen, dass diese Art in der Nähe von *Ichneumon* (= *Ephialtes* auct.) und *Scambus* steht (Roman 10, p. 161).

Unterstehende Tabelle zeigt die Unterschiede zwischen dem neuen Genus und den nächstverwandten Genera.

Flavopimpla BETR.	*Charitopimpla* CAM.	*Ichneumon* L. (*Ephialtes* Auct.) + ? *Exeristes* FRST.	*Scambus* HTG. + *Epiurus* FRST.
Körper gelb mit schwarzer Zeichnung.	Körper schwarz mit gelber Zeichnung.	Körper schwarz; Abdomen bisweilen mehr oder weniger rot.	Körper schwarz.
Augen unmerkbar ausgerandet.	Augen immer deutlich ausgerandet.	Augen nicht oder ganz schwach ausgerandet.	Augen sehr wenig ausgerandet.
Vertex breit; Kopf hinten wenig verschmälert.	V. schmal; Kopf hinten stark verschmälert.	V. breit; Kopf hinten kaum verschmälert.	V. oben etwas eingeschnitten.
Genae deutlich.	Genae fehlend.	—	Genae kurz, immer runzlig, matt.
Notauli ganz oder fast fehlend; beim ♂ vorn ziemlich deutlich.	Notauli deutlich.	Notauli deutlich.	Notauli deutlich.
Mediansegment oben glatt, mit nur wenigen, sehr feinen Punkte, fast ohne Längsleisten.	Mediansegment oben deutlich etwas grob punktiert, oder mit Spuren von Längsleisten.	Mediansegment meist runzlich; mit zwei Längsleisten, dazwischen vertieft.	Mediansegment höchstens mit zwei Längsleisten.
Spiracula nicht klein, rund bis oval.	Spiracula ziemlich gross, meistens oval.	Spiracula klein, rund.	Spiracula rundlich.
Segment 3(2) quadratisch. Hinterränder der T. nicht sehr breit und nicht erhöht; Tuberkeln des Abdomens deutlich; Abdomen ziemlich grob punktiert.	Segment 3(2) quadratisch bis quer; Hinterränder der T. breit; Tuberkeln des Abdomens gross; Punktierung grob.	Segment 3(2) bei *Ephialtes* länger wei breit, bei *Exeristes* breiter wie lang; Hinterränder breit, Abdomen grob punktiert; Tergite mit Tuberkeln.	Segment 3(2) breiter wie lang. Hinterränder der Tergite meistens nicht besonders breit und erhöht; Tergite beim Subgenus *Scambus* nicht mit Tuberkeln.
Bohrer gerade.	Bohrer gerade.	Bohrer am Ende etwas nieder gebogen.	Bohrer gerade.
Areola schief quadratisch.	Areola dreieckig, oft gestielt.	Areola dreieckig.	—
Nervellus in oder über der Mitte gebrochen.	Nervellus immer deutlich unter der Mitte gebrochen.	Nervellus meistens postfurkal und über der Mitte gebrochen.	Nervellus postfurkal, meistens jedoch suboppositus, in der Mitte, selten unter der Mitte gebrochen.

Flavopimpla mangae nov. spec.

Körper gelb; schwarz sind: die Spitzen der Mandibeln, die Augen, ein Mittelfleck auf der Facies, die Antennen mit Ausnahme des äussersten Endes des Scapus und eine Macula oberhalb der Antenneneinlenkungen, die sich nach hinten bis auf den Occiput fortsetzt und die zwei Spitzen auf der oberen, hinteren Orbita hat. Weiter sind schwarz: das Pronotum mit Ausnahme der Hinterecken und des Collums, drei breite Streifen auf dem Mesoscutum, wovon der mittlere nur bis zur Mitte reicht, die Seitenstreifen jedoch den Vorderrand nicht erreichen, die Scutellargrube und eine Macula vor dieser, die Frenalgruben des Scutellums, eine kleine Macula hinten auf dem Scutellum, das Metanotum mit Ausnahme der Frenalgrube, eine Macula auf den Mesopleuren, die die krenelierte Grube erreicht und oben eine Fortsetzung hat, welche die Vorderflügeleinlenkung erreicht, der Endrand des Mediansegmentes und die Endränder aller Tergite. Die schwarze Zeichnung dieser hat in der Mitte eine dreieckige Verbreiterung und ist auch an den Seiten stark verbreitert; die Bohrerklappen sind ebenfalls schwarz.

Coxen ganz gelb, Trochanter II teils, Trochanter III fast ganz schwarz. Die Femora gelb, alle mit kleiner, schwarzer Endmacula und einer grösseren Macula auf der Innenseite, Femora III hat zwei Maculae auf der Innenseite. Tibien gelb, Tibia I mit einem ziemlich langen, schwarzen Streifen, Tibia II mit einem kürzeren Streifen; Tibia III an der Basis und am Ende ziemlich breit schwarz. Tarsen I gelb, nur Klauen dunkel; Tarsen II dunkel, nur mittlere Glieder heller, Tarsen III ganz schwarz.

F l ü g e l hyalin, Endrand dunkler; Nervatur und Stigma schwarz; Basis des Stigmas schmal heller; Costa gelblich; Flügeleinpflanzung gelb.

K o p f glänzend; Basis der Mandibeln punktiert; Clypeus lang behaart, wie die Facies punktiert, schmal; Facies sehr weitläufig, fein punktiert, lang weiss, nicht dicht behaart; Facies unter den Antenneneinlenkungen in der Mitte etwas erhöht mit kurzem Kiel; Scrobi nicht deutlich; Ocelli ziemlich gross, dicht neben einander; Abstand zwischen den hinteren Ocelli kleiner wie der Abstand von diesen Ocelli bis zum Augenrand. Vertex oben tief eingedrückt; Tempora von oben gesehen so breit wie die Augen; hinter den Augen nicht verschmälert, weiter nach hinten gerundet. Genae so lang wie der Abstand von den Clypealgruben bis zu den Augen. Taster kurz.

T h o r a x. Pronotum glatt, hinten eckig eingeschnitten. Mesoscutum kurz behaart, sehr fein, nicht dicht p., Leisten des Seitenrandes nach vorn sich etwas weiter fortsetzend wie die punktförmigen Notauli. Scutellum breit flach gerundet, fein punktiert, behaart; Praescutellarleisten oben nicht scharf. Mesopleuren fein punktiert, hinten oben glatt; Punktgrube untief; krenelierte Furche bis oben deutlich, neben der Punktgrube nicht sehr deutlich eckig. Sternum punktiert, vorn mit Leiste, Mittelfurche deutlich. Metapleuren glatt, hinten mit Punkten, Flankenleiste vollständig, nur hinten undeutlich.

M e d i a n s e g m e n t flach, von der Basis an abschüssig, glatt, glänzend, fast nicht punktiert, die mehr oder weniger vertikalen Seiten deutlich fein punk-

tiert. Spiraculae klein, oval; Spiracularfurche besonders vorn tief. Mediansegment hinten mit einer Anfang von den Seitenleisten.

Abdomen. Tergit 2(1) vorn in der Mitte bis auf der Hälfte ausgehöhlt, diese Aushöhlung glatt, die Seiten dieser Aushöhlung gerandet; übrigens ist das Tergit ziemlich grob punktiert, hinter der Aushöhlung ist das Tergit nicht tafelförmig erhöht wie bei *Epiurus*, sondern nur rundlich erhöht. Tergit 3(2) quadratisch, vorn mit zwei tiefen, queren Gastrocölen, ihr Zwischenraum so breit wie eine Gastrocöle. Dieses Tergit ziemlich grob punktiert; Hinterrand schmal, glänzend, schwach querrunzlig. Zwei grosse, rundliche Tuberkeln auf jedem Tergit mit Ausnahme des Tergites 2(1) und der letzten; übrige Tergite mit Ausnahme der letzten punktiert wie Tergit 3(2), aber ohne Gastrocölen; Sternite fehlen bei der Type. Flügel und Beine, siehe die Figuren.

Länge ohne Bohrer 11 mm; Flügellänge 9 mm; Thoraxlänge 3 mm; Länge des Abdomens 7 mm; Länge des Bohrers 11,5 mm.

Holotype: Buitenzorg, Kp. Tjimanggoe.

Parasiet vermutlich des Larven des Manggakäfers (*Cryptorhynchus gravis* F.), 9. 12. 29, leg. VOÛTE.

♂. Ähnlich gefärbt wie das ♀. Kopf gelb; schwarz sind: Das Ende der Mandibeln, eine Macula oberhalb der Antenneneinlenkungen, die sich nach hinten bis zum Occiput fortsetzt und hinten oben auf den Orbita eine dreieckige Fortsetzung trägt. Auf der Facies nur ein undeutlicher, brauner Fleck, Scapus unten gelb, oben schwarz. Antennen dunkel, unten heller wie oben.

Thorax gefärbt wie beim ♀, jedoch Hinterecken des Pronotums gelb, Mesopleuren mit zwei Maculae, eine auf der Mitte neben der krenelierten Furche, die andere hinten, unter den Vorderflügeleinlenkungen. Frenula des Scutellums gelb. Beine gefärbt wie beim ♀, jedoch Femora II ganz gelb, auf den Femora III sind die zwei Maculae der Innenseite zu einer grossen Macula verschmolzen. Abdomen gefärbt wie beim ♀, Genitalklappen und Ende des letzten Sternites schwarz. Flagellum mit 30 Gliedern.

Struktur wie beim ♀; Tempora schmäler wie beim ♀; Notauli vorn ziemlich deutlich; Abdomen etwas gröber punktiert; Tergit 2(1) etwas länger, Höcker der Stigmata grösser, Tuberkeln auf dem Abdomen grösser, vorn auf Tergit 3(2) zwei schräge Furchen.

L. 9 mm; Fl. 1.8 mm.

Allotype: Buitenzorg, Tjiomas, 17-X-30, vermutlich aus einem Manggakäferlarve, leg. VOÛTE.

Zu diesem Genus gehören zweifellos auch die folgenden Arten.

F. nigromaculatus (CAM. 1899) [1]).

1899. Mem. Manch. Phil. Lit. Soc. 41, I. p. 150, ♀, *Ephialtes nigromaculatus*.
1913. MORLEY. Faun. Br. Ind. Hym. III, p. 179, ♀, f. 41. *Ephialtes nigromaculatus*.
1914. MORLEY. Rev. Ichn. B. M. III, p. 14. *Ephialtes nigromaculatus*.

[1]) FLETCHER T.B. (Rep.Sec.Ent.Meet.Pusa 1917) vermeldet das auftreten einer gelben Ichneumonide wie Parasit des Mangakäfers in the government-gardens in Maymyo in Burma. Ob ihm diese Art vorlag muss vorläufig dahin gestellt bleiben.

Diese Art unterscheidet sich, so weit aus der Beschreibung hervorgeht, in den folgenden Punkten von der typischen Art. Femora nicht schwarz gefleckt, Apex der Tibien nicht schwarz, Apex der Flügel nicht dunkler, Nervellus über der Mitte gebrochen. Diese Art ist in Assam gefunden. Die *Ephialtes nigritarsis* ist nicht das ♂ wie MORLEY 1914, l.c. p. 14 annimmt, weil das Mediansegment "strongly punctate" ist. Ich achte es nicht ausgeschlossen, dass die folgende Art das ♂ ist.

F. xanthostoma (MORLEY 1913).

1913. Fauna Br. Ind. Hym. III, p. 86, n.44. ♂. *Calliephialtes xanthostoma.*
1914. MORLEY. Rev. Ichn. B. M. III, p. 13. *Calliephialtes xanthosoma.*

Diese Art ist in Sikkim gefunden.

LITERATURVERZEICHNIS [1]).

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4. CUSHMAN. R. A.; Descriptions of new Ichneumonidae and taxonomic Notes; Pr.E.S. Washington XVII, p. 132-142, 1915.
5. —; New Indian Ichneumonidae; Rec. Ind. Mus. XXIX, p. 241-247, Calcutta 1927.
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11. SCHMIEDEKNECHT. Prof. Dr. O.; Pimplinae; Opuscula Ichneumonologica III, p. 1001-1403, Blankenburg i. Thüringen 1906-1908.
12. THOMSON. C. G.; Bidrag till kännedom om Sveriges Pimpler; Opuscula Entomologica, VIII, p. 732-777, Trelleborg 1877.

[1]) Die mit einem * bezeichneten Arbeiten standen nicht zu meiner Verfügung.

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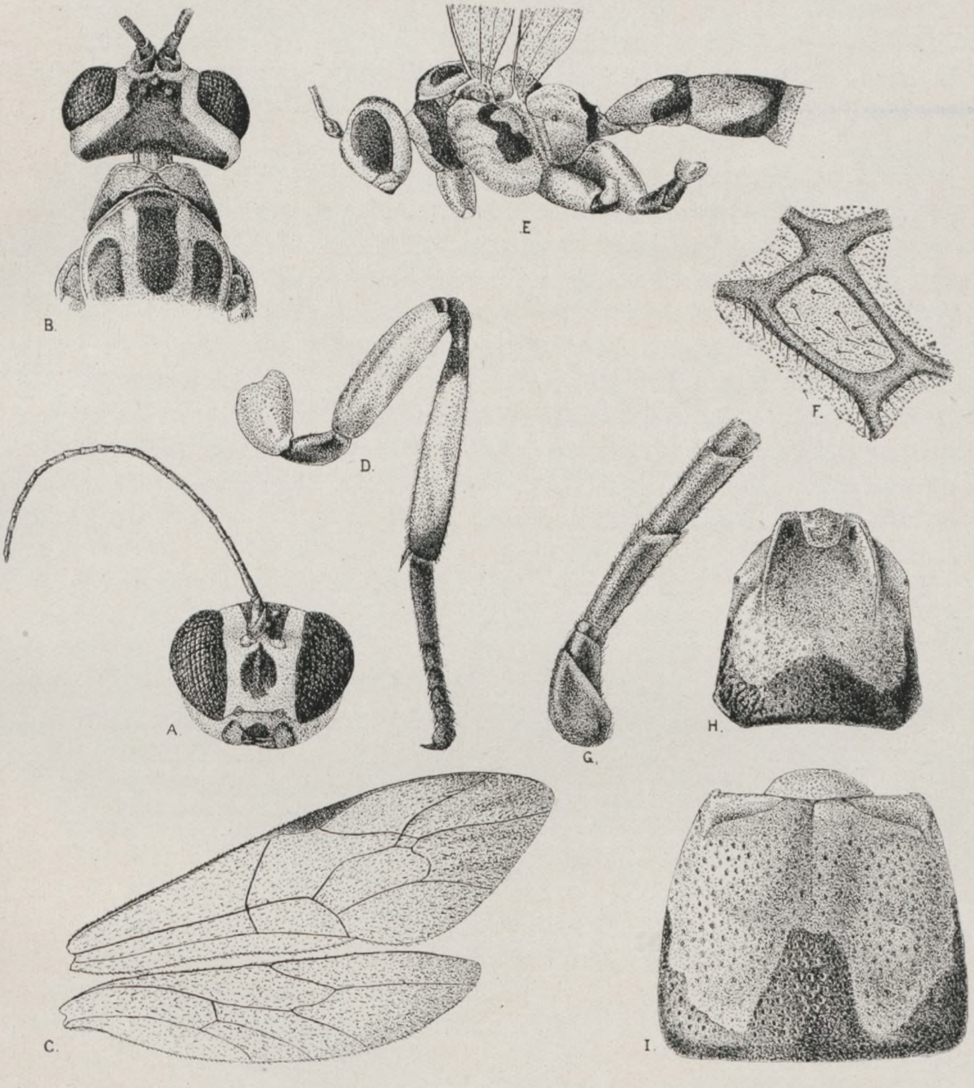

Flavopimpla mangae BETREM, ♀.

A. Kopf von vorn. — B. Kopf und vorderer Teil des Thorax von oben. — C. Flügel. — D. Hinterbein. — E. Kopf, Thorax und die ersten Tergite von der Seite. — F. Areola des Vorderflügels. — G. Basalglieder der Antenne. — H. Tergit 2(1). — I. Tergit 3(2).

NEUE POLYDESMIDEN DES MUSEUMS BUITENZORG.

Von

C. ATTEMS

(Wien).

Platyrhacus arrogans nov. sp. (Fig. 1-4).

Farbe des Rückens schmutzig kastanienbraun, die Seitenflügel vorn, seitlich und hinten schmal hellgelblich eingefasst, Antennen und Beine von der Farbe des Rückens. Breite der Metazoniten 14 mm, der Prozoniten 7½ mm. Kopf fein scharf granuliert, mit tiefer Scheitelfurche, am Rande des Clypeus eine Reihe von Supralabralborsten und darüber 4 im Halbkreis stehende Borsten. Auf dem Scheitel 1 + 1 oder keine Borsten. Halsschild trapezisch, (Fig. 1), Vorder- und Hinterrand gerade, die Seiten stark nach hinten convergierend, die Vorderecken breit abgerundet, die Fläche zerstreut granuliert, längs des Vorderrandes eine dichtgedrängte Reihe hell gefärbter Tuberkeln. Die vorderen Seitenflügel sind nach vorn gerichtet, vom 5. oder 6. Segment an sind sie quer

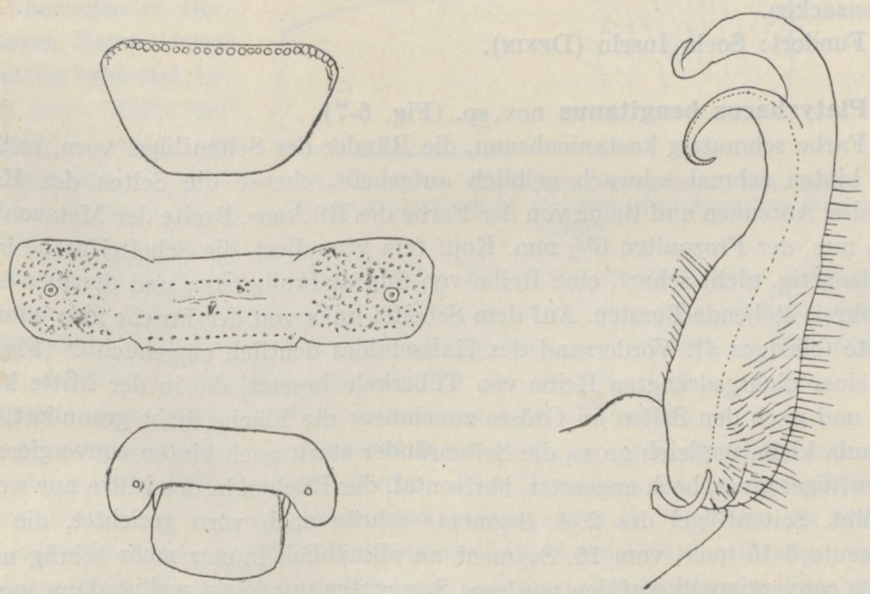

Fig. 1—4. — *Platyrhacus arrogans* **nov. sp. Halsschild, ♂ 7 Segment, ♂ Hinterende, und Gonopode, Medialseite.**

zur Längsachse, die hinteren vom etwa 16. Segment an sind nach hinten gerichtet, die Seitenränder sind bis zum 11. oder 12. Segment nach hinten convergierend, dann werden sie ganz allmählich parallel; sie sind schwach convex und glattrandig (Fig. 2). Vordereck überall abgerundet. Vorder- und Hinterrand

glattrandig. Hinterrand bis zum 15. Segment quer zur Längsachse, vom 16. Segment an allmählich immer mehr schräg nach hinten. Seitenflügel sehr gross, hoch angesetzt, horizontal, vorn und hinten eine kleine Schulter bildend, der Rücken zwischen ihnen nur mässig gewölbt. Saftlöcher mit grossem Ring, etwas hinter der Mitte und weit vom Seitenrand, fast so weit wie vom Hinterrand entfernt, gelegen. Rücken der Metazoniten sehr fein lederig mit 3 Querreihen sehr kleiner Knötchen, Oberseite der Seitenflügel ziemlich fein und sehr flach granuliert. Prozoniten fein chagriniert. Unterseite der Seitenflügel und die Flanken fein granuliert. Die Stigmen liegen auf niedrigen Querwülsten, dahinter ein schlanker Zapfen. Sternite fein granuliert, unbeborstet, bis zum 17. Segment neben jedem Bein ein grosser, spitzer Kegel bei ♂ und ♀; auf den vorderen Segmenten werden sie sehr klein und verschwinden mehr oder weniger in der dichten Beborstung; zwischen den hinteren Beinen des 6. Segments des ♂ fehlen sie. Schwänzchen schaufelförmig (Fig. 3), die Seiten bis zur Mitte parallel, dann im Bogen in den leicht gewölbten Hinterrand übergehend; Analschuppe trapezisch mit 2 grossen, die Mitte weit überragenden zitzenförmigen Borstenwarzen. Beine ringsum reichlich beborstet, nur die Hüfte in der distalen Hälfte der Unterseite kahl und glatt. Gonopoden (Fig. 4) im Ganzen kurz und gedrungen, Femur ohne Zacken, Tibialteil sehr kurz, die beiden Endäste ungefähr gleich gross und in der Form einander ähnlich, hakig gebogen, einfach d.h. ohne Seitenzacken.

Fundort: Soela Inseln (Denin).

Platyrhacus bengitanus nov. sp. (Fig. 5-7).

Farbe schmutzig kastanienbraun, die Ränder der Seitenflügel vorn, seitlich und hinten schmal schwach gelblich aufgehellt, ebenso die Seiten des Halsschildes, Antennen und Beine von der Farbe des Rückens. Breite der Metazoniten 12½ mm, der Prozoniten 6½ mm. Kopf fein granuliert, die Scheitelfurche breit muldenartig, nicht scharf, eine Reihe von Supralabralborsten und darüber 4 im Halbkreis stehende Borsten. Auf dem Scheitel links von der Furche eine winzige Borste (einziges ♂). Vorderrand des Halsschildes deutlich eingebuchtet (Fig. 5) mit einer dichtgedrängten Reihe von Tüberkeln besetzt, die in der Mitte klein sind und nach den Seiten an Grösse zunehmen; die Fläche dicht granuliert, die Granula klein, ungleich gross, die Seitenränder stark nach hinten convergierend. Seitenflügel gross, hoch angesetzt, horizontal, der Rücken in der Mitte nur wenig gewölbt. Seitenflügel des 2.-4. Segments schräg nach vorn gerichtet, die der Segmente 6-15 quer, vom 16. Segment an allmählich immer mehr schräg nach hinten convergierend, auf den vorderen Segmenten nur leicht wellig, dann immer deutlicher mit runden Höckern besetzt (Fig. 6), deren Zahl auf den porenlosen Segmenten 4, auf den porentragenden meist 5, auf den hintersten bis 7 beträgt. Vorder- und Hinterrand glatt, der Hinterrand vom 16. Segment an schräg nach hinten gerichtet, so dass das Hintereck einen stumpfen Lappen bildet. Seitenflügel des 19. Segments relativ schmale, abgerundete Lappen. Poren mit ziemlich grossem Ring, weit vom Seitenrand entfernt, fast so weit wie vom Hinterrand.

Rücken der Metazoniten in der Mitte fein und sehr flach granuliert, so flach, dass es schon ein Uebergang zu lederig gerunzelt ist, Seitenflügel deutlicher granuliert; 3 Querreihen kleiner Knötchen, von denen die der 2 vordern Reihen sehr undeutlich, die der dritten Reihe grösser, enger gestellt und sehr deutlich sind. Unterseite der Seitenflügel zerstreut, die Flanken dicht fein sandig granuliert, hinter den niedrigen Querwülsten für die Stigmen ein schlankes Zäpfchen. Sternite fein granuliert, unbeborstet, die des 8. - 17. Segments mit 4 grossen spitzen Kegeln; auf den Segmenten vor dem Kopulationsring sind sie sehr klein und verschwinden mehr oder weniger unter der dichten Beborstung der Hüften. Seiten des Schwänzchens parallel, abgerundet in den nur wenig convexen Hinterrand übergehend; Analschuppe abgerundet dreieckig, mit 2 grossen, die Mitte überragenden Borstenwarzen. Beine ventral sehr kräftig beborstet, besonders auch Hüfte und Praefemur, erstere von der Körpermitte an kahl und glänzend. Gonopoden (Fig. 7) kurz und gedrungen, am Grunde des Femur kein Zacken, der Tibialabschnitt sehr verkürzt, die beiden Endäste ungefähr gleich gross, beide einfach, ohne Seitenzacken, der Tibialfortsatz auf der Innenseite der Krümmung, gleichmässig im Halbkreis gebogen, der Tarsus winkelig, das Endstück fast gerade.

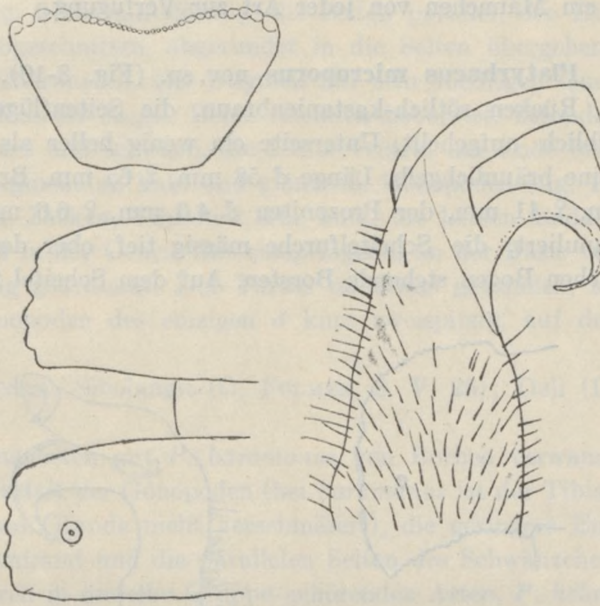

Fig. 5—7. — *Platyrhacus bengitanus* nov. spec. Halsschild, 14. & 15. Segment, und Ende des Gonopoden.

Fundort: Ben Gitan am Mahakam, Borneo (H. WITKAMP).

P. arrogans und *bengitanus* gehören in eine Gruppe mit *P. modestus, sumatranus gongylodes, moebiusi* und *druryi*. Der Halsschild ist bei *gongylodes, moebiusi, druryi* und *modestus* annähernd querelliptisch, in der Mitte am breitesten, während er bei *sumatranus, arrogans* und *bengitanus* trapezförmig, vorn am breitesten ist. *P. gongylodes, moebiusi* und *druryi* unterscheiden sich von *arrogans* und *bengitanus* ausserdem durch die viel gröbere Granulierung. Bei *sumatranus* ist der Vorderrand der Seitenflügel vom 5. Segment an, der Hinterrand vom 3. Segment an sägeartig schartig, während beide Ränder auf allen Segmenten bei *arrogans* und *bengitanus* glatt sind. *P. arrogans* und *bengitanus* unterscheiden sich untereinander durch die Form des Halsschildes und den Seitenrand der Seitenflügel. Bei *arrogans* ist der Vorderrand des Halsschildes

gerade und die Seitenecken sind nicht vorgebuchtet, bei *bengitanus* ist der Vorderrand deutlich eingebuchtet, so dass die Seitenlappen vorgebuchtet aussehen. Der Seitenrand der Seitenflügel ist bei *arrogans* glatt, bei *bengitanus* durch Einbuchtungen rundhöckerig. Die Gonopoden beider Arten zeigen zwar kleine Verschiedenheiten in der Krümmung der Endäste doch wäre es notwendig erst eine grössere Zahl von Individuen beider Arten zu untersuchen um entscheiden zu können, wie weit da die individuelle Variation geht; ich hatte leider nur je ein Männchen von jeder Art zur Verfügung.

Platyrhacus microporus nov. sp. (Fig. 8-10).

Rücken rötlich-kastanienbraun, die Seitenflügel am Seitenrand schwach gelblich aufgehellt, Unterseite ein wenig heller als der Rücken, Sternite und Beine bräunlichgelb. Länge ♂ 58 mm, ♀ 65 mm, Breite der Metazoniten ♂ 9.7 mm, ♀ 11 mm, der Prozoniten ♂ 4.6 mm, ♀ 6.6 mm. Kopf dicht fein sandig granuliert, die Scheitelfurche mässig tief, ober den Supralabralborsten 4 im flachen Bogen stehende Borsten. Auf dem Scheitel 2 + 2 Borsten. Halsschild nicht merklich breiter als der Kopf, fast regelmässig querelliptisch, die Fläche dicht fein granuliert, längs des Vorderrandes auf einem Wulst eine dichtgedrängte Reihe grösserer Tuberkeln, ebenso am Hinterrand eine Reihe grösserer Tuberkeln. Rücken mässig gewölbt, die Seitenflügel (Fig. 8) etwas weniger abfallend als die Rückenmitte, die der Segmente 2-4 ein wenig nach vorn gezogen, die Vorderecken überall abgerundet, der Hinterrand vom 5. Segment an allmählich immer deutlicher concav, wodurch das Hintereck zackig wird, auf den Segmenten 17 und 18 ist der Hinterrand geradlinig und stärker schräg nach hinten gerichtet, Seitenrand sehr schwach convex und kaum merklich wellig, nur auf den Segmenten 2 und 3 etwas deutlicher wellig, zugleich sind diese Seitenflügel abgerundet, die Seitenflügel des 19. Segments sind abgerundete Lappen. Vorder- und Hinterrand sehr fein gesägt. Rücken der Metazoniten dicht granuliert, auf den Seitenflügeln etwas gröber als auf

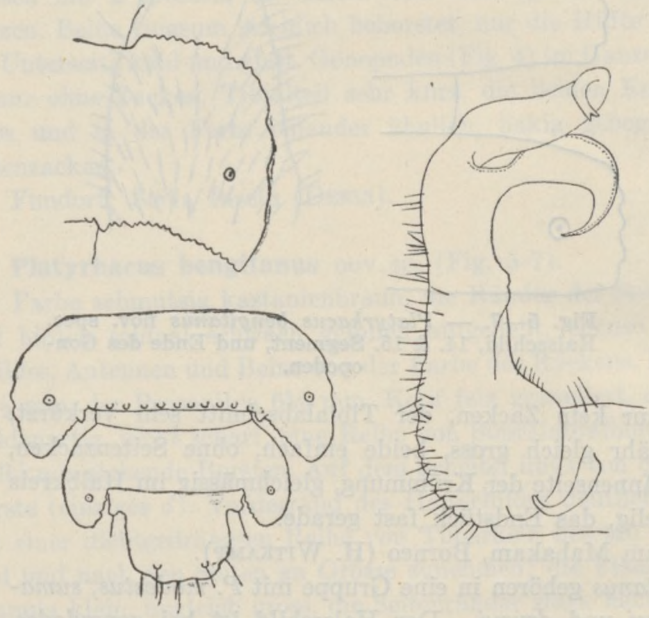

Fig. 8—10. — *Platyrhacus microporus* nov. spec. 15. Segment, Hinterende, und rechter Gonopode, Medialseite.

der Mitte, die Tuberkeln der 3 Querreihen sind nur wenig grösser als die Granula und verschwinden fast in der Granulierung, die der 3. Reihe sind nur auf den vordersten Segmenten etwas vergrössert und auf den anderen Segmenten 2 oder 3 an der etwas aufgeblasenen Basis der Seitenflügel stehende ebenfalls. Flanken fein granuliert, Prozoniten sehr dicht und fein chagriniert. Poren hinter der Mitte gelegen, vom Seitenrand um gut das Doppelte des kleinen Ringdurchmessers entfernt. Sternite sehr fein granuliert, unbeborstet, alle ohne Fortsätze. Schwänzchen (Fig. 9) schaufelförmig, die Seiten parallel, der Hinterrand fast gerade quer abgeschnitten, abgerundet in die Seiten übergehend, Schuppe mit 2 kleinen Borstenwarzen. Die Stigmen auf sehr niedrigen Querwülsten, hinter ihnen ein grösserer Kegel. Beine reichlich beborstet, besonders ventral, die Borsten eher kurz und schwach, die Hüfte ventral am Ende beim ♀ vom 6., beim ♂ vom 9. Segment an kahl und glänzend. Gonopoden (fig. 10) sehr gedrungen, Femur ohne Zacken, Tibialteil sehr kurz, die beiden Endäste sehr breit, der Tibialfortsatz in der Concavität entspringend, an der Basis verschmälert, stark sichelförmig gekrümmt. Der Tarsus ist etwas gewunden, am Ende auf dem rechten Gonopoden des einzigen ♂ kurz zweispitzig, auf dem linken einfach zugespitzt.

Fundort: Sumatra: Medan; Sibolangit (O. FULMEK, 8. V. 25); Deli (DE BUSSY).

P. microporus ist am nächsten mit *P. baramanus* von Borneo verwandt, von dem er sich durch die Gestalt der Gonopoden (bei *baramanus* ist der Tibialfortsatz sehr schlank und am Grunde nicht verschmälert), die geringere Entfernung der Poren vom Seitenrand und die parallelen Seiten des Schwänzchens unterscheidet. Bei den anderen in dieselbe Gruppe gehörenden Arten, *P. kelantanicus, xanthopus* und *laticollis,* sind beide Endäste des Gonopoden sehr schlank.

Platyrhacus singulus nov. sp. (Fig. 11).

Rücken dunkelbraun, die laterale Hälfte der Seitenflügel bräunlichgelb, auf den hinteren Segmenten vom etwa 14. an sind nur die Granula gelb, der Grund zwischen ihnen dunkelbraun; die Tuberkeln der drei Querreihen, besonders die der dritten Reihe, der Porenring, die Antennen, Sternite und Beine licht bräunlichgelb. Breite der Metazoniten 8.5 mm, der Prozoniten 4.3 mm. Kopf dicht fein granuliert, die Scheitelfurche seicht, oberhalb der Supralabralborsten 4 im Bogen stehende Borsten. Auf dem Scheitel zu jeder Seite der Furche 1-2 Borsten. Halsschild ein wenig breiter als der Kopf, querelliptisch, die Seiten symmetrisch verschmälert, die Fläche dicht granuliert, längs des Vorderrandes eine Reihe grösserer Granula, dahinter eine seichte Depression, längs des Hinterrandes ebenfalls grössere Granula. Rücken mässig gewölbt, die Seitenflügel breit, ihre Oberseite dieser Wölbung folgend, ihre vordere Kante horizontal. Seitenflügel der Segmente 2 - 4 etwas nach vorn gezogen, der 5. und 6. quer, der Vorderrand beginnt schon vor der Körpermitte ein wenig schräg nach hinten zu werden; das Hintereck ist vom 5. Segment an ungefähr rechtwinklig, vom 14. an beginnt es einen caudalwärts immer grösseren Zacken zu bilden, der auf dem 17. Segment

ein wenig einwärts gekrümmt ist; 19. Segment mit breiten abgerundeten Lappen. Der Vorderrand bildet am Grunde eine schwache Schulter, Vorder- und Hinterrand vom 7. Segment an fein gesägt. Seitenrand auf den vordern Segmenten gerade, die grösseren Granula liegen noch auf der Oberseite, vom 5. Segment an wird er durch vorstehende grosse Tuberkeln tief wellig gebuchtet. Metazoniten dicht und fein granuliert, die Granula sind in der Mitte sehr flach, auf den Seitenflügeln viel gröber; ausserdem 3 Reihen grösserer Knötchen, die der dritten Reihe grösser als die der anderen und durch ihre helle gelbe Farbe auffallend. Poren vom Rande so weit entfernt als der Durchmesser des ziemlich grossen Ringes beträgt. Unterseite der Seitenflügel und die Flanken fein granuliert, die Stigmen auf niedrigen Querwülsten, hinter ihnen ein schlankes Zäpfchen. Prozoniten sehr fein chagriniert. Sternite fein granuliert, unbeborstet, vom 8. Segment an mit 4 sehr niedrigen runden Höckern, die auf den Segmenten 17 und 18 sehr undeutlich werden. Seiten des Schwänzchens parallel, der Hinterrand in der Mitte gerade, abgerundet in die Seiten übergehend; Analschuppe fast trapezisch, der Hinterrand leicht convex, seine Mitte in einer Linie mit den zwei dicken Borstenwarzen. Borsten der Beine reichlich und stark, die distale Hälfte der Hüfte ventral glatt und glänzend. Die Gonopoden (Fig. 11) ähneln wohl sehr denen von *P. moebiusi;* während jedoch bei *moebiusi* beide Endäste im Profil gesehen ungefähr parallel zu einander sind, überkreuzen sie sich bei *singulus;* da ich von beiden Arten nur je ein ♂ untersuchen konnte, ist es noch unsicher ob dieser Unterschied constant ist.

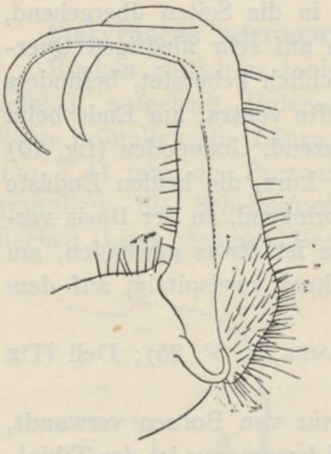

Fig. 11. — *Platyrhacus singulus* nov. spec. Gonopode.

Fundort: Sumatra: Merangin, Djambi (O. POSTHUMUS, 27. 7. 1925).

Als Unterschied von *P. moebiusi* ist ausser dem schon oben erwähnten in den Gonopoden liegenden auch die bedeutendere Grösse (*Moebiusi* ist 6.5 mm breit) und die deutlichere Entwicklung der drei Querreihen von Rückentuberkeln zu erwähnen.

Platyrhacus sucidus nov. sp. (Fig. 12-15).

Rücken dunkel rotbraun, die laterale Hälfte der Seitenflügel gelblich, Antennen fast so braun wie der Rücken, Flanken und Beine gelbbraun. Breite der Metazoniten 11 mm, der Prozoniten 6½ mm. Kopf dicht fein granuliert, die Scheitelfurche scharf, jederseits von ihr 2 oder 3 in einer Querreihe stehende Borsten, auf dem Clypeus oberhalb der Supralabralborsten 4 im Bogen stehende Borsten. Rücken ziemlich stark gewölbt, die breiten Seitenflügel folgen dieser Wölbung. Halsschild (Fig. 12) von recht charakteristischer Form, der Vorderrand fast gerade, die Seiten parallel, der Hinterrand schwach gebogen, das Vordereck in ein kleines lateral gerichtetes Läppchen ausgezogen, das Hintereck

breit abgerundet, die Fläche dicht fein granuliert, längs des Vorderrandes eine Reihe etwas grösserer Granula, am Hinterrand bis über die Wölbung der Hinterecken hinaus ca. 15 grosse, conische Granula, die über den Hinterrand vorstehen. Die Seitenflügel sind breit, ziemlich stark abfallend, der Vorderrand bildet am Grunde eine kleine Schulter, Seitenflügel der Segmente 2 - 4 schräg nach vorn gerichtet und die ersten 2 dabei abgerundet, die Seitenränder des 3. convergieren stark nach hinten. Vom 5. Segment an sind die Seitenränder parallel und die Ecken genau rechtwinklig, auch das Vordereck nicht im mindesten abgerundet, auf den hinteren Segmenten werden die Ränder etwas schräg nach hinten, wodurch die Winkel etwas grösser (Vordereck) oder etwas kleiner (Hintereck) als ein rechter werden ohne aber im mindesten abgeschliffen zu sein wie das sonst meist der Fall ist; 19. Segment mit abgerundeten Seitenlappen. Vorder- und Hinterrand fein sägeartig, Seitenrand fast glatt, nur sehr seicht wellig durch kleine längliche Randverdickungen. Poren fast in der Mitte zwischen Vorder- und Hinterrand, vom Seitenrand etwas weiter entfernt als

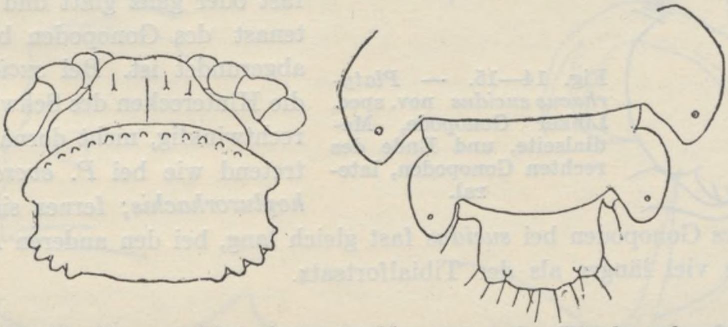

Fig. 12—13. — *Platyrhacus sucidus* nov. spec. Vorderende und Hinterende.

der grosse Aussenring im Durchmesser hat. Metazoniten dicht klein granuliert mit 3 Querreihen grösserer Granula, die der 3. Reihe sind besonders seitlich am Ansatz der Seitenflügel vergrössert, auf den Segmenten 2 - 4 ist diese Stelle sogar buckelig vorgewölbt; weiter hinten gleicht sich die Grösse der Tuberkeln immer mehr aus und vom etwa 14. Segment an sind die Tuberkeln der 3. Reihe nicht grösser als die der anderen. Unterseite der Seitenflügel und die Flanken dicht fein granuliert, die Stigmen auf niedrigen Querwülsten, hinter ihnen kein Zäpfchen. Prozoniten sehr dicht und fein chagriniert, ventral sehr fein granuliert. Schwänzchen (Fig. 13) fast rechteckig, die Seiten gerade und parallel, im scharfen rechten Winkel mit dem nur in der Mitte schwach nach hinten vorgewölbten Hinterrand zusammentreffend; Analschuppe mit 2 mässig grossen, die Mitte etwas überragenden Borstenwarzen. Sternite fein granuliert und zerstreut fein beborstet, bei ♂ und ♀ mit 4 grossen spitzen Kegeldornen bis zum 17. Segment, beim ♀ beginnen sie auf dem 4. Segment, beim ♂ auf dem 7. Segment zwischen den hinteren Beinen. Beine des ♂ ventral reichlich beborstet, dichter als beim ♀. Femur des Gonopoden (Fig. 14, 15) ohne Zacken, der Tibialabschnitt sehr kurz, die beiden Endäste basalwärts herabgebogen, der Tibialfortsatz in der Mitte

mit einem grossen, abgerundeten Seitenlappen, distal von diesem gekniet, das Ende gerade und spitz; Tarsus ein wenig länger als der Tibialfortsatz, ohne Seitenzacken, das Ende zugespitzt.

Fundort: Soela Inseln (DENIN).

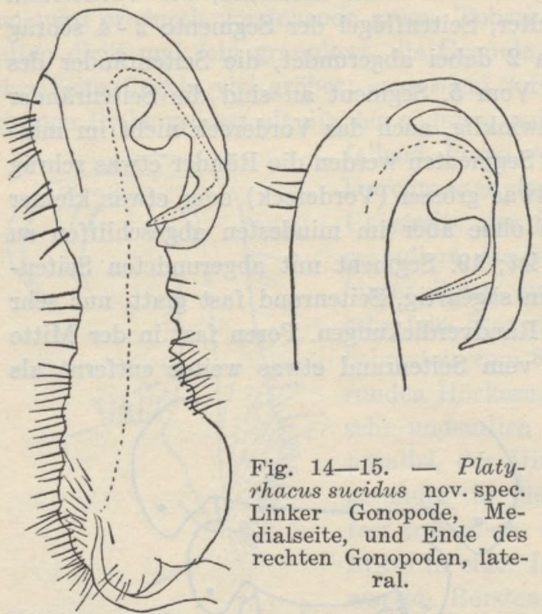

Fig. 14—15. — *Platyrhacus sucidus* nov. spec. Linker Gonopode, Medialseite, und Ende des rechten Gonopoden, lateral.

Diese Art ist am nächsten mit *P. subspinosus, everettii, hoplurorhachis* und *lamprus* verwandt. *P. subspinosus* unterscheidet sich von den anderen Arten dieser Gruppe dadurch dass der Seitenrand der Seitenflügel mit groben Tuberkelzähnen versehen und der Seitenast des Gonopodentarsus sehr schlank ist, während der Seitenrand der Seitenflügel bei den anderen Arten fast oder ganz glatt und der Seitenast des Gonopoden breit und abgerundet ist. Bei *sucidus* sind die Hinterecken des Schwänzchens rechtwinklig, nicht dornartig vortretend wie bei *P. everettii* und *hoplurorhachis;* ferner sind beide Endäste des Gonopoden bei *sucidus* fast gleich lang, bei den anderen Arten ist der Tarsus viel länger als der Tibialfortsatz.

Platyrhacus anambasius nov. sp. (Fig. 16 - 18).

Farbe sehr dunkel rotbraun, die Granula in der lateralen Hälfte der Seitenflügel gelblich, wodurch dieser ganze Teil der Seitenflügel aufgehellt erscheint. Antennen rotbraun, Beine gelbbraun. ♂ Länge 55 mm, Breite der Metazoniten 10 mm, der Prozoniten 5 mm. Kopf fein scharf sandig granuliert, Scheitelfurche deutlich, jederseits von ihr eine oder 2 Borste; ober den Supralabralborsten 5 im Bogen stehende Borsten. Halsschild querelliptisch, die Seiten abstehend, die Fläche dicht granuliert, die Granula ungleich gross, längs des Vorder- und Hinterrandes eine Reihe grösserer Granula, die vordere Reihe durch eine seichte Depression hinter ihr mehr oder weniger wulstig hervorgehoben. Rücken mässig gewölbt, Oberseite der Seitenflügel fast dieser Wölbung folgend, die vordere Kante auch etwas abfallend. Die vorderen Seitenflügel nicht ausgesprochen nach vorn gezogen, alle eckig dadurch, dass das Vordereck nicht abgerundet ist. Seitenflügel des 2. Segments auch nicht verschmälert sondern so wie die anderen. Vorderrand mit runder Schulter, vom 8. oder 9. Segment an beginnt er schräg nach hinten zu werden. Hinterrand vom 2. Segment an seicht concav, das Hintereck dadurch zackig, vom etwa 16. Segment an zieht der Hinterrand mehr geradlinig schräg nach hinten. Vorder- und Hinterrand fein sägeartig gezähnt. Seitenränder parallel mit 5 oder 6 runden Höckern (Fig. 16). Metazoniten

dicht granuliert, die Granula sind in der Mitte so flach, dass sie fast ganz erlöschen, auf den Seitenflügeln sind sie etwas gröber. Von den 3 Querreihen grösserer Knötchen sind die zwei vorderen Reihen auf den mittleren Segmenten so klein, dass sie fast in der Granulierung verschwinden, auf den hintern Segmenten sind alle drei Reihen ganz deutlich; die der dritten Reihe sind etwas grösser als die der anderen zwei Reihen. Poren mit grossem Ring, fast um das Doppelte des Ringdurchmessers vom Seitenrand entfernt, deutlich hinter der Mitte gelegen. Unterseite der Seitenflügel und die Flanken dicht fein granuliert; hinter den niedrigen Querwülsten mit den Stigmen ein schlankes Zäpfchen. Sternite fein granuliert, unbeborstet, vom 8. Segment an (♂) mit 4 kleinen sehr niedrigen Kegeln. Seiten des Schwänzchens (Fig. 17) parallel, der Hinterrand stark convex; Analschuppe ungefähr trapezisch, mit zwei dicken, die Mitte überragenden Borstenwarzen. Beine ringsum reichlich beborstet, die Borsten zart und von mittlerer Länge, die Hüfte ventral grossenteils kahl und glänzend.

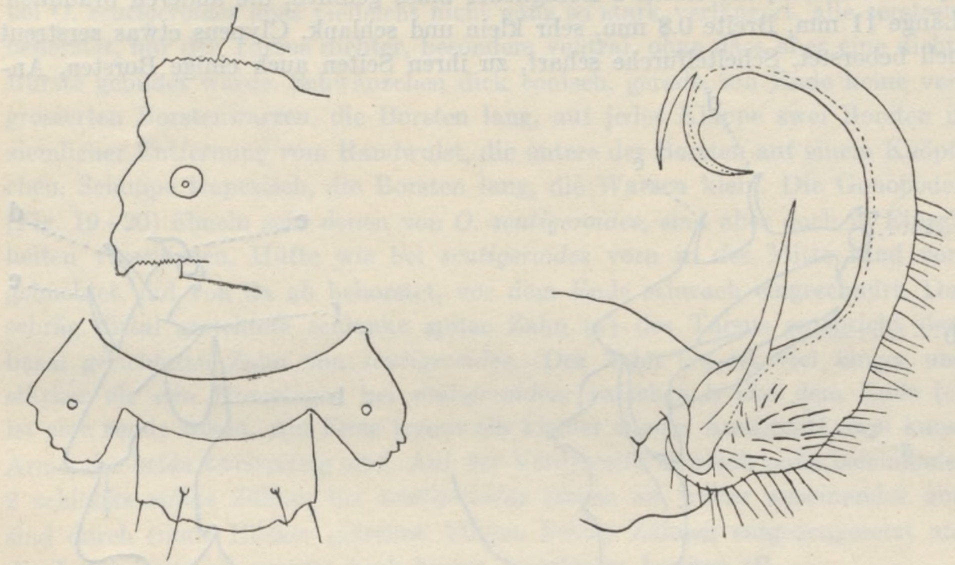

Fig. 16—18. — *Platyrhacus anambasius*, nov.spec. 10. Segment, Hinterende, und Gonopode.

Vom Femur des Gonopoden (Fig. 18) entspringt ein nach vorn gerichteter sehr schlanker, gerader, spitzer Spiess; das Telopodit ist relativ lang und schlank, mit langem Tibialabschnitt und kleinen Endästen. Der Tibialfortsatz hat einen runden Vorsprung auf der Hohlseite, der Tarsus ist schlank und spitz, wenig gebogen.

Fundort: Anambas Inseln.

Bei einer Anzahl *Platyrhacus*-Arten hat das Femur des Gonopoden einen schlanken spiessförmigen bis dickkegeligen Fortsatz; diese Arten sind: *P. mirandus, pictus, sublimbatus, scutatus, crassacus, doryphorus* und der hier als neu beschriebene *P. anambasius*. *P. doryphorus* mit seinem eine einfache Sichel bildenden Gonopoden gehört in das Subgenus *Haplorhacus,* alle anderen Arten

gehören zum Subgenus *Platyrhacus*. Bei *P. mirandus, pictus, sublimbatus* und *scutatus* convergieren die Seitenränder der Seitenflügel nach hinten und sind tief in spitze Zähne eingeschnitten; ferner ist bei ihnen der Halsschild vorn am breitesten mit nach hinten convergierenden Seiten und fast geradem Vorderrand. Bei *P. crassacus* und *anambasius* sind die Seitenränder der Seitenflügel parallel und haben nur ganz abgerundete Höcker; ihr Halsschild ist regelmässig querelliptisch. Von *P. crassacus* unterscheidet sich *P. anambasius* durch die Lage der Poren und die Gestalt der Gonopoden; die Poren liegen bei *crassacus* ganz seitlich, der Fortsatz des Gonopodenfemur ist bei *crassacus* ganz am Ende des beborsteten Femur und kurz dickkegelig. *P. crassacus* lebt in Borneo.

Orthomorpha filaria nov. sp. (Fig. 19 - 20).

Farbe dunkler oder heller kastanienbraun, Antennen ebenso, nur an der Spitze weisslich, die ersten 3 Beinglieder blass gelblich, die anderen bräunlich. Länge 11 mm, Breite 0.8 mm, sehr klein und schlank. Clypeus etwas zerstreut hell beborstet, Scheitelfurche scharf, zu ihren Seiten auch einige Borsten, An-

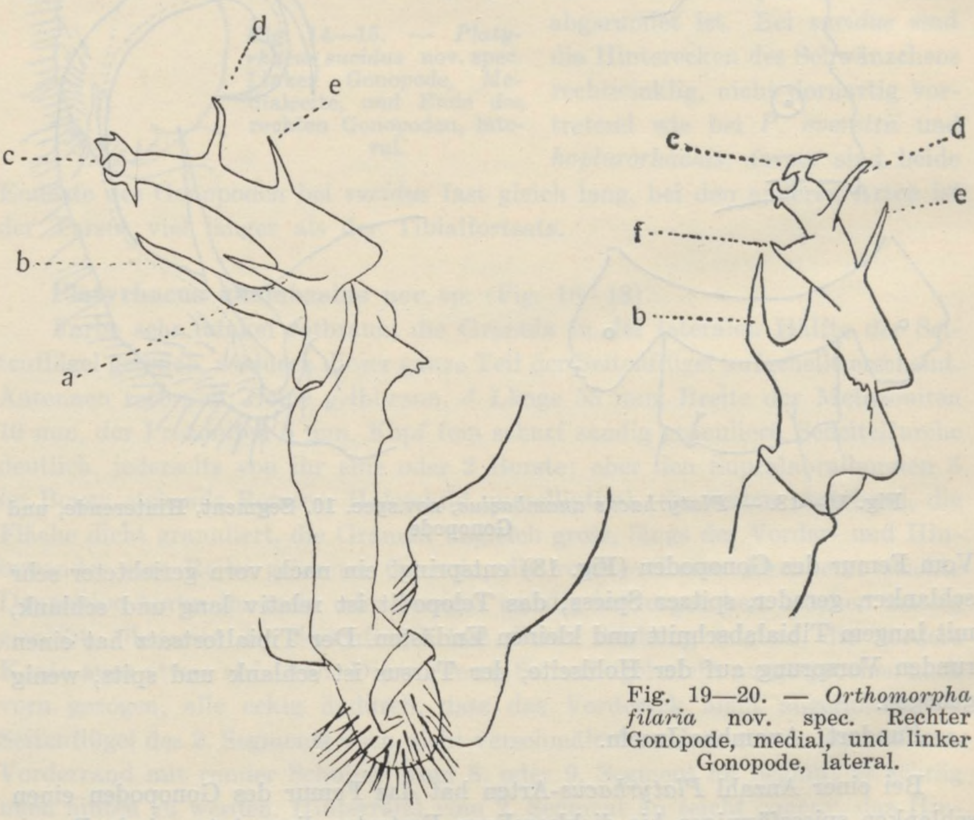

Fig. 19—20. — *Orthomorpha filaria* nov. spec. Rechter Gonopode, medial, und linker Gonopode, lateral.

tennen lang und schlank. Halsschild ungefähr halbkreisförmig mit geradem Hinterrand. Die Seitenwülste sind ganz schmal, dorsal scharf abgesetzt, nach vorn zu allmählich verlaufend, hinten bis zum 5. Segment abgerundet, dann

rechtwinklig, und vom 9. Segment an spitzzackig; dieser Zahn überragt aber auch auf den hinteren Segmenten nicht den Hinterrand. Die Poren liegen nahe dem Ende dieses Wulstes lateral gerichtet. Metazoniten glänzend fein polygonal gefeldert, mit ziemlich tiefer Querfurche; Nahe der Quernaht 4 lange abstehende Borsten, auf dem Seitenwulst etwas vor der Querfurche auf den Segmenten 2 - 5 oder 9 eine lange, aufrecht stehende Borste, am Hinterrand 6 nach hinten gerichtete Borsten; eine dritte Reihe wie bei *scutigeroides* ist auch auf den hinteren Segmenten nicht vorhanden. Am Vorderrand des Halsschildes 10 lange abstehende Borsten und am Hinterrand eine Reihe kürzerer Borsten. Seitenflügel des 2. Segments deutlich tiefer ventral, weder vorn noch hinten merklich ausgezogen. Ringe in der Quernaht ziemlich eingeschnürt, die Quernaht nicht geperlt. Pleuralkiele fehlen. Sternite zerstreut beborstet, Sternit 5 mit einer schmalen, beborsteten Lamelle zwischen den vordern Beinen, sonst keine Sternitfortsätze. Beine lang und schlank, die hinteren Paare ähnlich wie bei *O. scutigeroides* aber vielleicht nicht ganz so stark verlängert, alle zerstreut beborstet, nur der Tarsus dichter, besonders ventral, ohne dass aber eine dichte Bürste gebildet würde. Schwänzchen dick conisch, gerade, am Ende keine vergrösserten Borstenwarzen, die Borsten lang, auf jeder Klappe zwei Borsten in ziemlicher Entfernung vom Randwulst, die untere der Borsten auf einem Knöpfchen. Schuppe trapezisch, die Borsten lang, die Warzen klein. Die Gonopoden (Fig. 19 - 20) ähneln sehr denen von *O. scutigeroides,* sind aber doch in Einzelheiten verschieden. Hüfte wie bei *scutigeroides* vorn in der Mitte rund vorgebuchtet und von da ab beborstet, vor dem Ende schwach eingeschnürt. Der schräg distal gerichtete schlanke spitze Zahn (a) des Tarsus entspricht dem basal gerichteten Zahn von *scutigeroides.* Der Zahn (b) ist viel länger und stärker als sein Homologon bei *scutigeroides;* zwischen b und dem Ende (c) ist eine runde Bucht. Am Ende trennt ein kleiner runder Ausschnitt zwei kurze Arme, die beide zweispitzig sind. Auf der Vorderseite ziemlich nahe beieinander 2 schlanke spitze Zähne; bei *scutigeroides* stehen sie weiter auseinander und sind durch runde Höcker getrennt. Diesen beiden Zähnen entgegengesetzt auf der Lateralseite ein spitzer nach hinten gerichteter Lappen (f).

Fundort: W. Java: Tjibodas, 1400 m., (T. van Benthem Jutting, 3. X. 1930).

O. filaria ist eine nahe Verwandte von *O. scutigeroides* Att. (Arch. f. Hydrobiol. 1930 Suppl. Bd. 8 p. 128). Auf die durch die Gonopoden gegebenen Unterschiede habe ich schon oben hingewiesen, als weitere kommen dazu, dass bei *O. filaria* auch auf den hinteren Segmenten nur 2 Querreihen von Borsten vorhanden sind und dass die Pleuralkiele fehlen. Habituell sehen sich die beiden Arten wohl sehr ähnlich.

Orthomorpha hydrobiologica spinala nov. subsp. (Fig. 21 - 22).

Unterschiede von der Stammform:

1) Bedeutendere Grösse, Breite der Metazoniten 4 mm, der Prozoniten 2.5 mm. Hydrobiologica ist nur 3.3 mm breit.

2) Die Hinterecken der Seitenflügel sind in noch längere und spitzere Zacken ausgezogen (Fig. 21).

3) Die Gonopoden (Fig. 22) ähneln wohl sehr denen der Stammform, ihre Telopodite bilden auch hier ein Oval, doch sind sie merklich kräftiger als bei der Stammform.

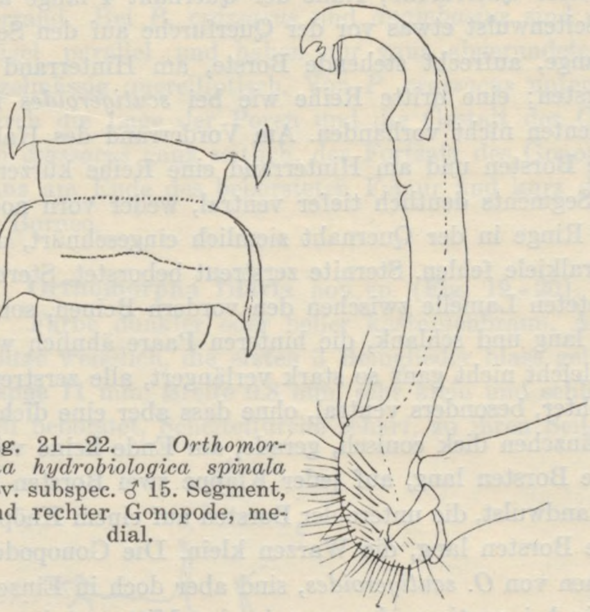

Fig. 21—22. — *Orthomorpha hydrobiologica spinala* nov. subspec. ♂ 15. Segment, und rechter Gonopode, medial.

Fundort: Karimon Djawa Inseln (DAMMERMAN, V. 1926).

O. hydrobiologica hat habituell und in den Gonopoden (Fig. 23-24) viel Aehnlichkeit mit der seit langem bekannten *O. coarctata* (Fig. 26). Von letzterer Art habe ich eine Form, *O.c. gigas*, beschrieben, die in der Grösse eine Brücke zwischen *coarctata* und *hydrobiologica* bildet; die Breite ist bei *coarctata* 1.9-2.1, bei *coarctata gigas* 2.5 mm, bei *hydrobiologica* 3.3 mm, bei *hydrobiologica spinala* 4 mm. Ueber die Unterschiede in den Gonopoden, die es ermöglichen die *coarctata*- und *hydrobiologica*-Formen sicher zu unterscheiden, habe ich mich schon bei Beschreibung der letztge-

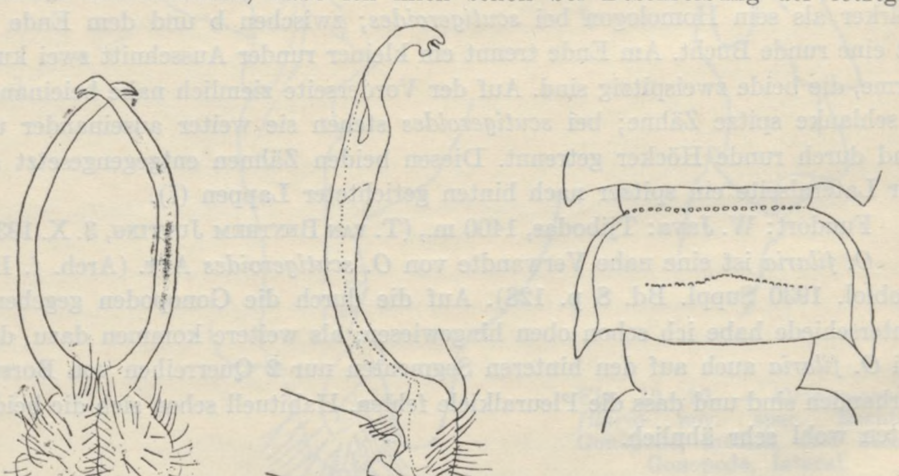

Fig. 23—25. — *Orthomorpha hydrobiologica* gen. ATT. Beide Gonopoden von der Ventralseite, linker Gonopode, und ♂ 15. Segment.

nannten Art ausgelassen und ist nur notwendig auf die sonstigen Unterschiede zwischen beiden Arten hinzuweisen. Bei *O. hydrobiologica* sind die Seitenflügel (Fig. 25) deutlich etwas nach oben gerichtet, bei *coarctata* horizontal, ihre Hinterecken sind bei der ersten Art etwas einwärts gekrümmt, bei der zweiten gerade. Die Hinterecken des Halsschildes sind bei *coarctata* abgerundet, bei *hydrobiologica* spitzzackig. Die Metazoniten und Sternite sind bei *coarctata* unbeborstet, bei *hydrobiologica* steht vor der Querfurche eine Reihe von einigen Borsten und sind die Sternite zerstreut beborstet. Die Telopodite der Gonopoden sind von der Ventralseite gesehen bei *coarctata* fast parallel, bei *hydrobiologica* schliessen sie ein breites Oval ein.

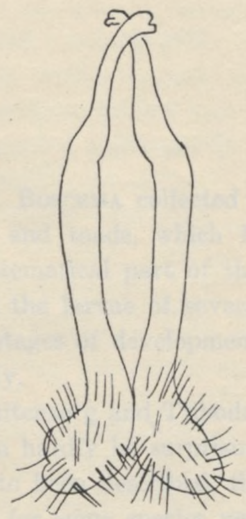

Fig. 26. — *Orthomorpha coarctata gigas* ATT. **Gonopoden von der Ventralseite.**

Akamptogonus signatus var. **extinctus** nov. var.

Farbe sehr dunkel braunschwarz ohne helle Rückenzeichnung. In allen übrigen Merkmalen, insbesonders in den Gonopoden völlig dem *A. signatus* gleichend. Die zuerst beschriebene Form dieses Kreises, *A. signatus,* hat einen hellen Medianfleck auf den Metazoniten, eine später publizierte Subspecies, *A. s. continuus,* hat auf dem Metazonit einen durchlaufenden hellen Medianstreif und unterscheidet sich ein wenig in den Gonopoden von *signatus*. Da die hier besprochene Form in den Gonopoden völlig mit *A. signatus* übereinstimmt, fasse ich sie nur als Varietät dieser Art. Sie gleicht in der Farbe dem *A. beauforti,* doch sind *A. beauforti* und *signatus* mit seinen verschiedenen Formen durch die Gonopoden leicht zu unterscheiden, wovon man sich durch einen Vergleich der von mir publizierten Abbildungen leichter als durch Worte überzeugen kann.

Fundort: Bobo (Sangi & Talaud Exped.).

nannten Art ausgelassen und ist nur notwendig auf die sonstigen Unterschiede zwischen beiden Arten hinzuweisen. Bei O. *hydrobiologica* sind die Seitenflügel (Fig. 25) deutlich etwas nach oben gerichtet, bei *coarctata* horizontal; ihre Hinterecken sind bei der ersten Art etwas einwärts gekrümmt, bei der zweiten gerade. Die Hinterecken des Halsschildes sind bei *coarctata* abgerundet, bei *hydrobiologica* spitzeckig. Die Metazoniten und Sternite sind bei *coarctata* unbeborstet, bei *hydrobiologica* steht vor der Querfurche eine Reihe von einigen Borsten und sind die Sternite zerstreut beborstet. Die Telopodite der Gonopoden sind von der Ventralseite gesehen bei *coarctata* fast parallel, bei *hydrobiologica* schliessen sie ein breites Oval ein.

Fig. 25. — *Orthomorpha coarctata gigas* Att. Gonopoden von der Ventralseite.

Akamptogonus signatus var. **extinctus** nov. var.

Farbe sehr dunkel braunschwarz ohne helle Rückenzeichnung. In allen übrigen Merkmalen, insbesonders in den Gonopoden völlig dem *A. signatus* gleichend. Die zuerst beschriebene Form dieses Kreises, *A. signatus* hat einen hellen Medianfleck auf den Metazoniten, eine später publizierte Subspecies, *A. s. continuus*, hat auf dem Metazonit einen durchlaufenden hellen Medianstreif und unterscheidet sich ein wenig in den Gonopoden von *signatus*. Da die hier besprochene Form in den Gonopoden völlig mit *A. signatus* übereinstimmt, fasse ich sie nur als Varietät dieser Art. Sie gleicht in der Farbe dem *A. beaufortsi*, doch sind *A. beaufortsi* und *signatus* mit seinen verschiedenen Formen durch die Gonopoden leicht zu unterscheiden, wovon man sich durch einen Vergleich der von mir publizierten Abbildungen leichter als durch Worte überzeugen kann.

Fundort: Bobo (Sangi & Talaud Exped.).

NOTES ON SOME TADPOLES, TOADS AND FROGS FROM JAVA

by

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Some years ago during a residence in Java, Dr. H. BOSCHMA collected a fairly large number of tadpoles and some adult frogs and toads, which he kindly left to me for examination. The result of the systematical part of this work is presented in this paper. As Dr. BOSCHMA reared the larvae of several species from the eggs and preserved them at successive stages of development, there is still a rich material left for embryological study.

Most of the animals being collected near Batavia, Buitenzorg and Tjibodas — all thoroughly investigated parts of the island — it can hardly be surprising that only three larvae were found, which had not hitherto been described, the species being known from adult specimens only. Besides for some species new localities could be recorded.

The collection was made from October 1920 till May 1921. Nearly all the material is excellently preserved in formaline 4%. As the larvae hardly (if at all) shrink in this fluid, formaline is much to be preferred to alcohol, in which the shrinking is considerable.

I have refrained from giving a complete list of the literature on the subject, as this can be found in VAN KAMPEN, Amphibia of the Indo-Australian Archipelago, 1923. Only the works that I actually used and the literature after 1923, have been cited under each species and in the bibliography at the conclusion of the paper.

I am indebted to Prof. Dr. P. N. VAN KAMPEN for valuable advice and criticism on this subject, which has been his special field of research for so many years.

Moreover Dr. K. W. DAMMERMAN, Director of the Zoological Museum at Buitenzorg, kindly furnished me with identified tadpoles from this Institution, which in some cases were useful to me for comparison.

PELOBATIDAE.

Megalophrys montana KUHL & v. HASSELT.

Megalophrys montana BOULENGER, 1882; WEBER, 1898; ANNANDALE, 1917; SMITH, 1917; VAN KAMPEN, 1923.

L o c a l i t i e s: Tjibodas — many tadpoles.

Tjibeureum — many tadpoles and a few adults.

The larvae were found in December, January and April in running water, sometimes together with the tadpoles of *Bufo cruentatus, Megalophrys hasselti, Rana kuhli* and *Rhacophorus javanus.*

Megalophrys hasselti (S. MÜLLER).

Leptobrachium hasselti BOULENGER, 1890; VAN KAMPEN, 1907.

Megalophrys hasselti BOULENGER, 1908; VAN KAMPEN, 1909 and 1923; ANNANDALE, 1917; SMITH, 1925.

L o c a l i t i e s: Tjibodas and environs (Tjiwalen, Tjibogo) — tadpoles.

Tjiapoes, on the slope of the mount Salak — tadpoles.

Many larvae of various sizes were caught in running water in December, January, April and July, together with those of *Meg. montana, Rana kuhli* and *Rana macrodon.* They are all of the uniformely coloured greyish brown type.

BUFONIDAE.

Bufo cruentatus TSCHUDI.

Bufo cruentatus HORST, 1883; VAN KAMPEN, 1923.

Bufo montanus WERNER, 1897.

L o c a l i t i e s: Tjibeureum and environs; wood with many little waters.

Some adult frogs were captured and several tadpoles, which have not been described hitherto and which probably belong to this species, as will be discussed after the description of the larva.

Description of the tadpole (fig. 1).

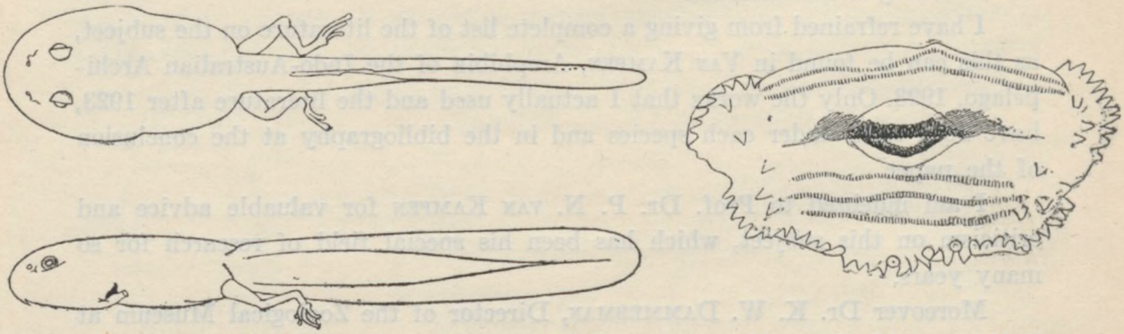

Fig. 1 & 2. Tadpole and mouth of the tadpole of *Bufo cruentatus.*

Body: regularly elliptical in outline, its length one and a half to twice its breadth.

Eyes: dorsal, nearer to the tip of the snout than to the spiraculum. Interorbital space one third to nearly half of the breadth of the body measured across the eyes.

Nostrils: somewhat nearer to the eyes than to the tip of the snout; rather wide apart the distance between them nearly equal to the interorbital space.

Spiraculum: not conspicuous, sinistral and nearly equally distant from the tip of the snout and from the vent.

Anus: medial at the end of a fairly wide tube, which generally is a little shifted to the right imitating a dextral situation of the vent. In somewhat older larvae with well developed hindlegs, however, the ventral crest does not fully extend to the root of the tail and the medial position of the anus is clearly visible.

Mouth: (fig. 2) ventral, somewhat wider than the interorbital space; one row of pointed papillae borders the upper lip along its sides and the lower lip all along without interruption; at the sides of the mouth a few stray papillae are often found within this row.

Series of teeth: $\frac{1\,|\,1}{3}$. The interruption in the second row on the upper lip is very narrow and may be absent. The three rows on the lower lip are subequal in length. Jaws rather narrowly edged with black and finely serrate.

Tail: more than one and a half times as long as the body and three to three and a half times as long as deep, the depth remaining practically the same throughout the tail. Tip broadly rounded. Crests rather narrow and hardly convex. The dorsal crest does not extend to the root of the tail but ends at a little and variable distance from the body, the last part being a low, rather thick ridge. At about two thirds of its length the muscular portion of the tail suddenly narrows considerably and the crests broaden correspondingly.

In older tadpoles the toes are webbed to the slightly swollen tips; even along the fourth toe the web is continued as a shallow ridge. On the thighs and shins the limbs have some indistinct dark cross-bars.

Colour: back and sides of the body and muscular portion of the tail lighter or darker brown to nearly black with a velvety sheen especially in dark specimens. Belly and crests colourless, often with a very delicate powdering of brown on the lower parts of the dorsal crest and the caudal end of the ventral crest. The colourless skin is very transparent.

Dimensions: total length 21-27 mm.
length of body 8,5-10,5 mm.
breadth of body 4-6,5 mm.
length of tail 12-17 mm.
depth of tail 4-5 mm.

Unfortunately the young frogs just after their metamorphosis cannot be identified beyond doubt and when Dr. BOSCHMA tried to rear the tadpoles of *Bufo cruentatus* from the eggs, they all died at very young embryonic stages of development. So there is no conclusive evidence that this new tadpole belongs to *Bufo cruentatus,* but I think it highly probable for the following reasons.

Assuming that Tjibodas and its neighbourhood have been too thoroughly investigated for any new species to be found there, only *Nectophryne borbonica, Bufo cruentatus, Rana hascheana, Rana doriae* and the javanese species of *Philautus* and *Nyctixalus* need to be considered as their tadpoles are not yet

known [1]). *Philautus* and *Nyctixalus* can be dropped because their fingers and toes have conspicuous disks, which are lacking in fourlegged specimens of the new tadpole. Moreover the tadpole of *Philautus vittatus,* described by Mr. M. SMITH in 1924, is of a rather different type. Neither can the tadpole belong to *Rana hascheana* or *R. doriae* as both lack an outer metatarsal tubercle, which is distinct in older specimens of the new larva and the toes of the two species of *Rana* under discussion have distinct though small disks, whilst the toes of my tadpole are only slightly swollen. Consequently the only two possibilities left are that the tadpole belongs either to *Bufo cruentatus* or to *Nectophryne borbonica.* This agrees very well with the distinctly bufonid type of the tadpole, viz., the stout uniformely coloured body, the broad roundtipped tail and the medial position of the vent. In some respects, however, it differs from the known bufonid tadpoles:

1°. the lower lip is entirely bordered by papillae (not only at its sides).
2°. starting from the middle the spiral of the intestine is sinistral whereas in other bufonid tadpoles it is generally dextral.

The choice between *Nectophryne borbonica* and *Bufo cruentatus* is not easy because of the great resemblance between the adults of the species. However *Nectophryne* has not yet been recorded from Tjibeureum and the highest elevation from which it is known, is some 400 m lower than Tjibeureum's 1624 m. On the other hand *Bufo cruentatus* is abundant in the forests where these tadpoles were collected. So unless the contrary be proved I take them to belong to this species. They were found in stagnant or slow running water together with the larvae of *Megalophrys montana, Rana kuhli* and *Rhacophorus javanus* during the months December, January and April.

Bufo melanostictus SCHNEID. and **B. biporcatus** GRAVENHORST.

Bufo melanostictus & *B. biporcatus* FLOWER, 1896; VAN KAMPEN, 1909 and 1923.

Bufo melanostictus PARKER, 1925; OKADA, 1926; SMITH, 1925 a.

Bufo biporcatus SMITH, 1927.

Localities: Buitenzorg and environs (Tanah Sereal, Tjikeumeuh, Tjisadane, Tjitajam and Weltevreden — tadpoles.
Telok Djambe near Krawang — tadpoles.
Djolok and Tjipanas near Tjibodas — tadpoles.

As the tadpoles of *Bufo melanostictus* and *B. biporcatus* cannot be distinguished from each other and both species are very common round Buitenzorg, it is very likely that they were mixed when collected. Only the tadpoles from Tjipanas and Djolok near Tjibodas probably belong to *Bufo biporcatus* as *B. melanostictus* is not known to occur at so high an elevation, whereas *B. biporcatus* has already been recorded from Tjipanas and Tjibodas.

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[1]) The tadpole of *Rana microdisca* is described in this paper.

The tadpoles were collected from October till May generally in sawahs and small pools, sometimes together with the larvae of *Microhyla achatina, Rana limnocharis, R. cancrivora, R. chalconota, R. erythraea, R. kuhli, Oœidozyga (Oxyglossus) lima* and *Rhacophorus leucomystax.*

Measurements of tadpoles of *Bufo cruentatus.*

	Total length	Length of body	Breadth of body	Length of tail	Depth of tail
	22 mm.	9 mm.	4 mm.	13,5 mm.	4 mm.
	22 "	9,5 "	6 "	13	4,5 "
	23,5 "	9,5 "	5 "	14 "	5 "
	25,5 "	10 "	5,5 "	16 "	4,5 "
	26 "	10 "	5,5 "	16 "	4 "
	27,5 "	10,5 "	5,5 "	17 "	5 "
fore legs showing through the skin	22 "	9,5 "	6 "	13,5 "	4,5 "
	23 "	9,5 "	6 "	14 "	5 "
	24,5 "	9,5 "	5 "	15 "	4 "
	26 "	10 "	5,5 "	16,5 "	5 "
tadpoles with *four* legs	23 "	9 "	4,5 "	14,5 "	4 "
	25 "	10 "	5 "	15 "	4,5 "
	26,5 "	10 "	5 "	16,5 "	5 "
beginning of reduction of tail	21 "	9 "	4 "	12,5 "	3,5 "
	20 "	8,5 "	3,5 "	12 "	2,5 "
	Young	frogs	with	remains	of tail
	16,5 mm.	9 mm.	—	8,5 mm.	—
	12,5 "	9,5 "	—	3,5 "	—
	—	8,5 "	—	1,5 "	—

The colour of the larvae varies from light brown to dark velvety brown or black. In some cases Dr. BOSCHMA noted that they were black or dark brown at the moment of capture, whereas they are very much lighter after fixation. The transparency of the crests, contrasting sharply with the dark coloured muscular portion of the tail is very characteristic.

It is remarkable, that fourlegged tadpoles and young toads just after metamorphosis often have a dark crossbar on the thighs and shins though the adults of the species show no trace of them.

Bufo parvus BOULENGER.

Bufo parvus BOULENGER, 1887; SMITH, 1916; ANNANDALE, 1917; SMITH, 1922; VAN KAMPEN, 1923.

Localities: Tjibodas and neighbourhood (Gegerbintang, Djember, Rarahan, Goenoeng batoe and Tjadasgantoeng) — tadpoles.
Buitenzorg (Tanah Sereal) — tadpoles.

These tadpoles, which agree in every respect with SMITH's description (1916), were found in ponds and pools during the months December and January, sometimes accompanied by the larvae of *Rana chalconota* and *R. nicobariensis*.

The localities round Tjibodas are situated at an elevation of 1200-1400 m. Hitherto Badjoelmati in the residence of Besoeki was the only place on Java from which *B. parvus* has been recorded and Badjoelmati lies in the plain. But as *B. parvus* is known to occur at higher elevations, e.g. on Sumatra (Batak Mountains 900 m), its presence near Tjibodas need not be very surprising.

In his notes Dr. BOSCHMA describes the colour of the living tadpoles as dark brown or black with a reddish brown breast. Preserved in formaline 4% they are light brown with a still lighter coloured tail.

The tadpole of *B. parvus* resembles the larvae of *Bufo melanostictus* and *B. biporcatus* but can be distinguished from them by the following characteristics.

1°. In the tails of *B. melanostictus* and *B. biporcatus* the muscular portion is darkly pigmented and contrasts vividly with the very transparent crests. In *B. parvus* the colour of the muscular portion is much lighter especially near the tip of the tail, where it is hardly different from the crests, which are considerably less transparent than in *B. melanostictus* and *B. biporcatus*.

Moreover the tail of *B. parvus* generally is broader in proportion to its length (ANNANDALE 1917).

2°. The second row of teeth on the upper lip has a much wider interruption in *B. melanostictus* and *B. biporcatus* than in *B. parvus* (ANNANDALE 1917). In young larvae however this does not hold good or the difference is less obvious.

3°. In *B. melanostictus* and *B. biporcatus* the nostrils are often relatively wider than in *B. parvus*.

4°. Generally the tadpoles of *B. parvus* are larger and stouter than those of *B. melanostictus* and *B. biporcatus*.

BREVICIPITIDAE.

Microhyla palmipes BOULENGER.

Microhyla palmipes BOULENGER; VAN KAMPEN, 1923; PARKER, 1928.

Microhyla annectens p.p. VAN KAMPEN, 1923.

Localities: Neighbourhood of Buitenzorg — frogs.
Tjibodas — frogs and tadpoles.
Goenoeng poetri near Tjibodas — tadpoles.
Tjibeureum — frogs and tadpoles.

According to PARKER (1928) the only species of the genus *Microhyla* which inhabit Java are *M. achatina* and *M. palmipes* and all specimens recorded from Java as *M. annectens* should be referred to *M. palmipes*. As a matter of fact all adult specimens in this collection lack the median groove on the surface of the digital disks and have a small tubercle on the posterior half of the upper eyelid: they belong to *M. palmipes*.

Besides adult frogs the collection includes some new typically brevicipitid tadpoles, which probably belong to *Microhyla palmipes* BLGR. They cannot be the larvae of *Microhyla achatina* because they lack the typical lower lip, which characterizes this species. Neither can they belong to *Kaloula baleata* as a comparison with identified specimens from the Buitenzorg Museum showed beyond doubt. Moreover *Kaloula baleata* is only known from the lower parts of the country and these tadpoles were taken at elevations of 1410 m, 1483 m and 1624 m, where *Microhyla palmipes* is rather common.

D e s c r i p t i o n: (fig. 3).

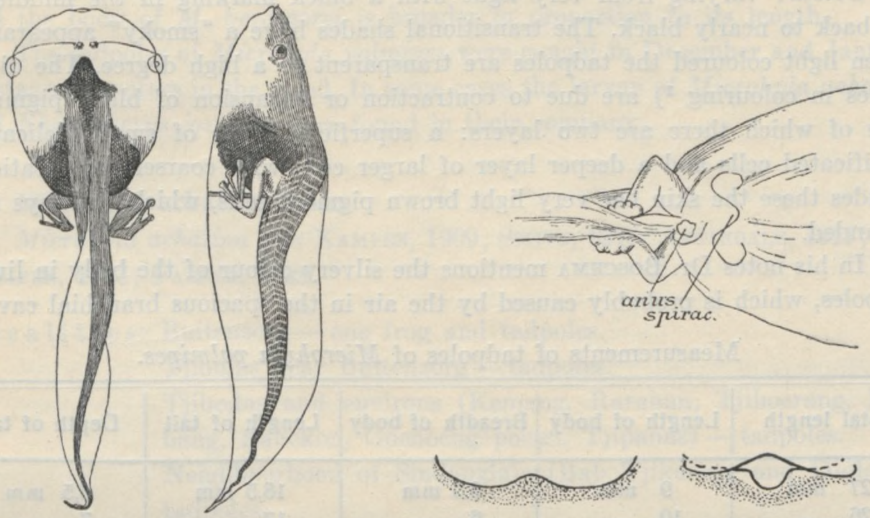

Fig. 3—5. Tadpole, anus and spiraculum, and mouth of the tadpole of *Microhyla palmipes*, shut and open.

Body: broadly oval; its length one and a half times its breadth. The greatest breadth lies near the anterior end between the eyes. Owing to the wide spiracular tube the body is much deeper at its posterior end than near the mouth.

Eyes: perfectly lateral.

Nostrils: rather nearer to the eyes than to the tip of the snout; closely together, the distance between them being only 1/6 to 1/5 of the interorbital space.

Mouth: (fig. 5) devoid of jaws or teeth; terminal and therefore hardly visible in dorsal view. Upperlip nearly straight, closing over the lower lip.

Spiraculum: (fig. 4) ventral and median at a little distance in front of the vent. Its form is very characteristic: a wide tube with a round emargination in the hinder edge and two small rounded lobules on either side of the emargination, (c.f. NARYAN's fig. of *Kaloula variegata*, 1918).

Anus: median at the end of a narrow, straight tube through the ventral crest.

Tail: One and a half to nearly two times the length of the body; its length two and a half to nearly three times its depth; terminating in a short flagellum

(which, however, has often been lost in preserved specimens). The muscular portion of the tail is attached to the body at an extremely dorsal level, it is even somewhat projecting, which gives the tadpoles a peculiar hunchbacked appearance. Owing to the dorsal attachment of the muscular portion the dorsal crest is practically obsolete at the root of the tail whilst the ventral crest has its greatest depth there. Halfway down the tail both crests are equally deep and both are slightly convex. The last narrow part of the muscular portion is not straight but undulating in the plane of the tail.

Hindlegs: webbed to the disks.

Colour: varying from very light with a black marking in the middle of the back to nearly black. The transitional shades have a "smoky" appearance. When light coloured the tadpoles are transparent to a high degree. The differences in colouring [1]) are due to contraction or expansion of black pigment-cells of which there are two layers: a superficial layer of small, delicately ramificated cells and a deeper layer of larger cells with coarser ramifications. Besides these the skin has very light brown pigment-cells, which I always saw expanded.

In his notes Dr. BOSCHMA mentions the silvery colour of the belly in living tadpoles, which is probably caused by the air in the spacious branchial cavity.

Measurements of tadpoles of *Microhyla palmipes.*

Total length	Length of body	Breadth of body	Length of tail	Depth of tail
27 mm	9 mm	6,5 mm	18,5 mm	6,5 mm
26 „	10 „	6 „	17 „	7 „
26 „	9 „	6 „	17,5 „	6 „
25 „	9,5 „	6,5 „	16 „	6,5 „
25 „	9 „	6,5 „	16,5 „	—
25 „	8,5 „	6 „	17 „	5,5 „
24 „	9 „	6 „	15 „	5,5 „
24 „	8 „	5,5 „	15,5 „	6,5 „
23,5 „	9 „	6,5 „	14,5 „	5 „
23 „	9 „	6 „	15 „	5,5 „
23 „	8 „	6 „	15,5 „	6 „
20,5 „	8 „	5,5 „	12,5 „	6 „
20 „	8,5 „	6 „	12,5 „	6 „
20 „	8 „	6 „	12 „	5 „
19 „	8 „	5 „	12 „	5 „

Dimensions: total length: 22-27 mm.
length of body: 8,5-10 mm.
breadth of body: 5-7 mm.
length of tail: 12-17 mm.
depth of tail: 5-7 mm.

[1]) DR. BOSCHMA mentions a case when darkly coloured tadpoles caught in broad daylight had turned very light after transport to the laboratory in darkness. This points to an influence of the light on the pigment-cells.

The resemblance between the tadpoles of *Microhyla palmipes* and *Kaloula baleata* is so close as to be almost deceptive, at least in dorsal view when the smaller eyes of *K. baleata* are the only difference. They can be distinguished from each other by characteristics of the tails and especially by the peculiar form of the spiraculum in *M. palmipes*. The spiraculum in *K. baleata* is narrower and lacks the typical emargination as well as the lateral lobules.

Judging after the description and figures of SMITH (1924) the likeness — also in dimensions — between the larvae of *Microhyla berdmorei* and *M. palmipes* is stronger still. The tails however furnish some distinctive characters and the body of *M. berdmorei* is broader in proportion to its length.

The tadpoles of *Microhyla palmipes* were caught in December and January in stagnant waters in the wood. In some cases the larvae of *Microhyla achatina* and *Rhacophorus javanus* were found in their company.

Microhyla achatina BOIE.

Microhyla achatina VAN KAMPEN, 1909; SMITH, 1916; ANNANDALE, 1917; VAN KAMPEN, 1923; PARKER, 1928.

L o c a l i t i e s: Buitenzorg — one frog and tadpoles.
Tjiomas near Buitenzorg — tadpoles.
Tjibodas and environs (Kemang, Rarahan, Tjihoerang, Koebang, Babekon, Goenoeng poetri, Tjipanas) — tadpoles.
Neighbourhood of Sindanglaja (Bab Tjikalong and Djolok — tadpoles.
Krawang (Telok Djambe) — tadpoles.
Djember — tadpoles.

The highest elevation at which these tadpoles were collected being 1482 m (Goenoeng poetri), these localities once more confirm the statement that *M. achatina* does not occur above 1600 m. It was not found near Tjibeureum (1624 m). The tadpoles were found in stagnant water of sawahs, ponds and the like from the end of October till the end of April, sometimes together with the larvae of *Microhyla palmipes, Rana limnocharis, Rana kuhli, Rana chalconota, Rhacophorus leucomystax, Rhacophorus javanus* and *Bufo melanostictus* (or *B. biporcatus*).

Some of the tadpoles exceed the maximal sizes cited in literature, their dimensions being:

Total length	body length	Tail length
26,5 mm	8,5 mm	18 mm
27,5 „	9 „	19 „
28 „	9 „	19 „
28,5 „	10 „	19 „

RANIDAE.

Rana limnocharis BOIE.

Rana limnocharis VAN KAMPEN, 1909; SMITH, 1917; ANNANDALE, 1917; BOULENGER, 1920; VAN KAMPEN, 1923; PARKER, 1925; SMITH, 1925 a; OKADA, 1926.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiomas, Tjisadane, Tjiliwoeng) — frogs and tadpoles.
Tjibodas and environs (Djolok, Rarahan, Koebang, Babekon)— frogs and tadpoles.
Sindanglaja (Bab Tjikalong) — 2 frogs.
Soerabaja — 1 tadpole.

Of this species a very numerous material including tadpoles of several different sizes has been collected from October till April. Most of them were found in sawahs, others in ponds, pools or solokans; always in stagnant or nearly stagnant water. Often they were accompanied by the larvae of *Rana cancrivora,* in other cases by those of *Rana chalconota, Rana macrodon, Microhyla achatina, Rhacophorus leucomystax, Rhacophorus reinwardti, Oœidozyga lima* and *Bufo melanostictus* (or *B. biporcatus*).

Rana cancrivora GRAVENHORST.

Rana tigrina and *R. tigrina* var. *angustopalmata* VAN KAMPEN, 1907.
Rana tigrina VAN KAMPEN, 1909.
Rana tigrina var. *cancrivora* and *R. cancrivora,* ANNANDALE and BOULENGER, 1920.

Rana cancrivora ANNANDALE, 1917; BOULENGER, 1920; VAN KAMPEN, 1923; SMITH, 1927.

Localities: Buitenzorg and environs (Tanah Sereal, Tjisadane, Tjiliwoeng) — frogs and tadpoles.
Babekon near Tjibodas — frogs and tadpoles.

These tadpoles were found from October till January in sawahs and nearly always together with the larvae of *Rana limnocharis,* in one case with these of *Oœidozyga lima.* The tadpoles of *R. cancrivora* are deceptively like those of *R. limnocharis.* All the same it is possible to draw up some distinctive characters, which, though not conclusive each apart, may furnish sufficient evidence when occurring in combination, especially when tadpoles of both species taken at the same place and time can be compared as was the case with this material. Nevertheless there are always cases where a conclusion is practically impossible and greatly a matter of personal appreciation.

These distinctive characters were derived from older tadpoles, which judging from their hindlegs belong without doubt to *R. cancrivora.*

Afterwards they were applied to younger specimens and apparently they hold good. They can be drawn up as follows:

1°. The tadpoles of *R. cancrivora* are nearly always bigger than those of *R. limnocharis.* If one compares tadpoles with equally long hindlegs, those of *R. cancrivora* have the bigger bodies. On the other hand: if tadpoles of the same body-length are compared, those of *R. limnocharis* have further developed hindlegs.

The 1st table draws a comparison between the sizes of tadpoles of both species collected at the same time and place, divided into 6 categories:

a. young frogs with remains of the tail,
b. tadpoles with four legs and unreduced tail,
c. tadpoles with the forelegs showing clearly through the skin,
d. tadpoles with hindlegs longer than 10 mm,
e. tadpoles with hindlegs from 10-4 mm,
f. tadpoles with hindlegs up to 4 mm.

a. In young frogs with remains of the tail the body-length varies as follows:

Tanah Sereal: *Rana limnocharis* 12-13 mm, average 12,6 mm.
Rana cancrivora 13,5-16 mm, average 14,3 mm.
Tjisadane: *Rana limnocharis* 10,5-12 mm, average 11,4 mm.
Rana cancrivora 13 mm, average 13 mm.

Calculated from the entire material the average body-length is:

Rana limnocharis 12,83 mm.
Rana cancrivora 14,15 mm.

b. Unfortunately only very few tadpoles with four legs and unreduced tail were available. Therefore only the average body-length for the entire material was calculated:

R. limnocharis: 11,5-14 mm, average 12,92 mm.
R. cancrivora: 13-17 mm, average 15,25 mm.

c. Of both species tadpoles with forelegs clearly showing through the skin were taken at Tanah Sereal, Buitenzorg. The variability of their body-length is:

R. limnocharis: 13-15 mm, average 13,96 mm.
R. cancrivora: 15,5-18 mm, average 16,78 mm.

Average body-length calculated from the entire material:

Rana limnocharis 13,85 mm.
Rana cancrivora 16,41 mm.

At this stage the tadpoles attain their largest size.

d. Of *R. cancrivora* only very few tadpoles with hindlegs longer than 10 mm were found at different localities. Their body-lengths vary from:
13,5 mm — 15,5 mm, average 14,71 mm.

TABLE I.

A. Measurements of young frogs with remains of tail.

Locality	*Rana cancrivora.* Total length	Length of body	Length of tail.	*Rana limnocharis.* Total length	Length of body	Length of tail.
Tanah Sereal	— mm	14 mm	8 to 9 mm	18 mm	13 mm	5 mm
Buitenzorg	— „	14 „	± 8	— „	13 „	9,5 „
	17,5 „	13,5 „	4 „	16,5 „	12 „	4,5 „
	15 „	13,5 „	1,5 „	18 „	13 „	5 „
	15 „	14,5 „	0,5 „	16,5 „	13 „	3,5 „
	15,5 „	15 „	0,5 „	16 „	12 „	4,5 „
	—	13,5 „	visible but	14,5 „	12 „	2,5 „
	—	14 „	to short	15,5 „	12,5 „	3 „
	—	15 „	to be	15 „	12,5 „	2,5 „
	—	16 „	measured.	13,5 „	13 „	0,5 „
				13 „	12 „	1 „
				13 „	12 „	1 „
				—	12 „	— tip broken
				—	13 „	
				—	12,5 „	—
				—	13 „	visible
				—	13 „	— but too
				—	13 „	— short to
				—	13 „	— be mea-
				—	13 „	— sured
				—	12 „	—
Tjisadane	14,5 „	13 „	1,5 „	16 „	11,5 „	5 „
Buitenzorg	20,5 „	13 „	7	14 „	11,5 „	3 „
				12 „	11,5 „	0,5 „
				12,5 „	12 „	1 „
				11,5 „	10,5 „	1 „
				—	15,5 „	9 „
Babekon	17,5 „	16 „	1,5 „	18 „	15 „	3,5 „
near				17 „	14,5 „	2,5 „
Tjibodas				17 „	16 „	1,5 „
Tanah Sereal				17 „	12,5 „	4,5 „ too short to be measured.
Tjihoerang				19,5 „	14,5 „	5,5 „
				13 „	12 „	1 „
				14 „	13,5 „	1 „
				—	14 „	too short to be measured.

TABLE Ia.

B. Measurements of tadpoles with four legs.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail.	Total length	Length of body	Length of tail.
Tjisadane	34 mm	13 mm	21 mm	29,5 mm	11,5 mm	18 mm
	35 „	14 „	21 „			
Tanah Sereal	43,5 „	17 „	27 „	33 „	13,5 „	20 „
Babekon	40 „	17 „	23 „			
Tjisadane				33 „	14 „	19 „
Tjihoerang				28 „	13 „	15,5 „
				—	12 „	18 „
Tjisadane				31 „	12,5 „	18,5 „
Tanah Sereal				34,5 „	14 „	21 „

C. Measurements of tadpoles with forelegs showing through the skin.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail.	Total length	Length of body	Length of tail.
Tjisadane	40,5 mm	15,5 mm	25 mm	36 mm	14 mm	22,5 mm
				35,5 „	13,5 „	22 „
				37 „	14 „	23 „
				37 „	14 „	23 „
				38,5 „	14 „	24,5 „
				36 „	13 „	23 „
				37,5 „	14 „	23,5 „
				36 „	13,5 „	21,5 „
				33 „	13 „	20 „
				35,5 „	14 „	22 „
				36 „	14 „	22 „
Tjisadane	42,5 „	16 „	26,5 „	34,5 „	13,5 „	21 „
				36 „	13,5 „	23 „
				36,5 „	13,5 „	23 „
				34 „	13,5 „	21 „
				36 „	13 „	23 „
Tanah Sereal	39,5 „	15,5 „	24 „	36 „	14 „	22 „
Tjisadane	41,5 „	16,5 „	25 „	35,5 „	14,5 „	21,5 „
				33 „	15 „	18,5 „
Tanah Sereal	47,5 „	17,5 „	30,5 „	37 „	14 „	23 „
	43 „	17 „	26,5 „	36,5 „	14 „	23 „
	49 „	18 „	31,5 „	36,5 „	14 „	22 „
	41,5 „	17,5 „	24,5 „	38,5 „	15 „	23,5 „
	39,5 „	15,5 „	24 „	39 „	15 „	24 „
	34,5 „	16 „	19 „	38 „	15 „	23 „
	39,5 „	16 „	24 „	38 „	14 „	24,5 „
				36 „	13,5 „	22,5 „
				33,5 „	13,5 „	20 „
				34,5 „	13 „	21,5 „
				36 „	14,5 „	22 „
				33 „	13 „	20 „
				35,5 „	13,5 „	22 „
				35 „	14 „	21,5 „
				36,5 „	14 „	22,5 „
				34 „	13,5 „	21 „
Tjisadane	38 „	15 „	23 „	37 „	13,5 „	24 „
				26,5 „	12,5 „	14 „

TABLE Ib.

D. Measurements of tadpoles with hindlegs longer than 10 mm.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail	Total length	Length of body	Length of tail
Tjisadane	34,5 mm	15,5 mm	19 mm	33 mm	12,5 mm	19,5 mm
				32,5 ,,	12,5 ,,	20 ,,
				31 ,,	12 ,,	19 ,,
				31,5 ,,	13 ,,	18,5 ,,
				34,5 ,,	13 ,,	21,5 ,,
				35 ,,	13,5 ,,	21,5 ,,
Tanah Sereal	34,5 ,,	14,5 ,,	20 ,,	31 ,,	13,5 ,,	17,5 ,,
				35,5 ,,	13 ,,	23 ,,
				34 ,,	13 ,,	21 ,,
				33,5 ,,	13 ,,	20,5 ,,
				32,5 ,,	12,5 ,,	20 ,,
				33 ,,	13 ,,	20 ,,
				34 ,,	13 ,,	21 ,,
				34 ,,	13 ,,	21 ,,
				36 ,,	13 ,,	23 ,,
				36 ,,	13 ,,	23 ,,
				33 ,,	13 ,,	20 ,,
				33,5 ,,	13 ,,	21 ,,
				34 ,,	13 ,,	21 ,,
				34,5 ,,	12,5 ,,	22,5 ,,
				35 ,,	13 ,,	22 ,,
Tjisadane	37 ,,	13,5 ,,	24 ,,	36 ,,	14 ,,	22 ,,
	—	16 ,,	—	36 ,,	14 ,,	22 ,,
Tjisadane	36 ,,	15 ,,	21,5 ,,	35 ,,	15 ,,	20,5 ,,
	36 ,,	14,5 ,,	22 ,,	36 ,,	15 ,,	21,5 ,,
				35,5 ,,	14,5 ,,	21 ,,
				36 ,,	14,5 ,,	21,5
				36 ,,	15,5 ,,	21 ,,
				35,5 ,,	14 ,,	21,5 ,,
				34,5 ,,	14,5 ,,	20 ,,
				33 ,,	14 ,,	19 ,,
Tanah Sereal	35,5 ,,	15 ,,	20,5 ,,	35 ,,	13,5 ,,	21,5 ,,
				36 ,,	13,5 ,,	23 ,,
				35 ,,	13,5 ,,	21,5 ,,
				35 ,,	13,5 ,,	21,5 ,,
				34,5 ,,	13 ,,	21,5 ,,
				34 ,,	13 ,,	21 ,,
				35 ,,	13 ,,	22 ,,
				32 ,,	12,5 ,,	19,5 ,,
				32,5 ,,	13 ,,	20 ,,
				34 ,,	13 ,,	21 ,,

TABLE Ic.

E. Measurements of tadpoles with hindlegs from 10 to 4 mm.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail	Total length	Length of body	Length of tail
Tanah Sereal	34,5 mm	13,5 mm	21 mm	31 mm	12 mm	19 mm
	32 ,,	13 ,,	19,5 ,,	36 ,,	14 ,,	22 ,,
	32,5 ,,	13 ,,	20 ,,	33 ,,	12 ,,	21 ,,
	29,5 ,,	13,5 ,,	16 ,,	32,5 ,,	13 ,,	20 ,,
	32 ,,	12,5 ,,	20 ,,	30 ,,	12 ,,	18,5 ,,
				29,5 ,,	11 ,,	18,5 ,,
				29 ,,	11 ,,	18 ,,
				29 ,,	11 ,,	18 ,,
				28 ,,	11 ,,	17 ,,
Tjisadane	–	14 ,,	–	30 ,,	12,5 ,,	17,5 ,,
	36,5 ,,	14 ,,	22,5 ,,	29 ,,	11,5 ,,	18 ,,
	36 ,,	14 ,,	22,5 ,,			
	35 ,,	14 ,,	21,5 ,,			
Tjihoerang	37,5 ,,	15 ,,	23 ,,	31,5 ,,	12 ,,	19,5 ,,
	31 ,,	14,5 ,,	16,5 ,,			
Tjisadane	33,5 ,,	14 ,,	20 ,,	31,5 ,,	12 ,,	19,5 ,,
	32,5 ,,	15 ,,	18 ,,	32 ,,	12,5 ,,	19 ,,
	35,5 ,,	13,5 ,,	22 ,,	31 ,,	12 ,,	19 ,,
				32 ,,	12 ,,	20 ,,
				30,5 ,,	12 ,,	18,5 ,,
				29 ,,	11 ,,	18 ,,
				28,5 ,,	11 ,,	17,5 ,,
				31 ,,	11 ,,	20 ,,
Tjisadane	35,5 ,,	14,5 ,,	21 ,,	34 ,,	13 ,,	21,5 ,,
				32,5 ,,	13,5 ,,	19,5 ,,
				33 ,,	13 ,,	22 ,,
				30,5 ,,	12,5 ,,	18 ,,
				29,5 ,,	12,5 ,,	17 ,,
Tanah Sereal	32,5 ,,	13 ,,	20 ,,	33,5 ,,	12,5 ,,	20,5 ,,
				32 ,,	12,5 ,,	20 ,,
				31 ,,	12 ,,	19 ,,
Tjisadane				32 ,,	12 ,,	20 ,,
				29,5 ,,	11 ,,	19 ,,
				28 ,,	10 ,,	18 ,,
				28 ,,	11 ,,	17,5 ,,
				28 ,,	10 ,,	18 ,,
Tanah Sereal				31 ,,	11 ,,	20 ,,
				31,5 ,,	11,5 ,,	20,5 ,,
				30 ,,	10,5 ,,	19,5 ,,
				30 ,,	11 ,,	19 ,,
Tanah Sereal	38,5 ,,	14,5 ,,	24,5 ,,			
	36 ,,	14 ,,	22,5 ,,			
	37,5 ,,	14 ,,	23,5 ,,			
Babekon	35 ,,	14 ,,	21 ,,			
Tjibodas	34,5 ,,	13,5 ,,	21 ,,			
	—	12 ,,	— ,,			

TABLE Id.

F. Measurements of tadpoles with hindlegs up to 4 mm.

Locality	*Rana cancrivora.*			*Rana limnocharis.*		
	Total length	Length of body	Length of tail	Total length	Length of body	Length of tail
Tjisadane	31 mm	13 mm	18 mm	29,5 mm	12 mm	18 mm
	29,5 „	12,5 „	17 „	29,5 „	11,5 „	18 „
	27 „	12 „	17,5 „	27 „	10,5 „	17 „
Tjisadane	29 „	12,5 „	16,5 „	27,5 „	10,5 „	17 „
				25 „	10 „	15 „
				24 „	9 „	15 „
Tanah Sereal	32 „	13 „	19,5 „	30,5 „	11,5 „	19 „
	30 „	11,5 „	18,5 „	27 „	10,5 „	17 „
	28 „	11 „	17,5 „	25,5 „	10 „	15,5 „
	23,5 „	10,5 „	13 „	26 „	10 „	16 „
	25 „	10 „	15 „			
Tjihoerang				29,5 „	11,5 „	18,5 „
Buitenzorg				26 „	10 „	16,5 „
				25,5 „	9,5 „	16 „
				24 „	9,5 „	15 „
Tanah Sereal				25 „	9,5 „	16 „
				23,5 „	9 „	15 „
Tjisadane				27,5 „	10 „	17,5 „
				26 „	9,5 „	16,5 „
				27 „	10 „	17 „
				23 „	9 „	14 „
				23,5 „	9 „	14,5 „
				22,5 „	8,5 „	14,5 „
Tanah Sereal	33 „	13 „	20 „			
	30,5 „	12,5 „	18 „			
	33 „	12 „	21 „			
	30,5 „	11,5 „	19 „			
	30,5 „	12 „	19 „			
	29,5 „	11,5 „	18 „			
	20,5 „	11 „	18,5 „			

At this stage *R. limnocharis* (material from several localities) has a body-length of 12-15,5 mm, average 13,35 mm. When the tadpoles of each locality are treated separately the following values for the body-length of *R. limnocharis* are found:

Tjisadane: 12-13 mm, average 12,6 mm,
„ : 14-15,5 mm, average 14,62 mm,
Tanah Sereal: 12,5,-13,5 mm, average 13 mm,
„ : 12,6-13,5 mm, average 13,15 mm.

In every case *R. limnocharis* is smaller than *R. cancrivora.*

e. Tadpoles with hindlegs from 10-4 mm.
Body-length of:

	Rana limnocharis.	*Rana cancrivora.*
Tanah Sereal	11-14 mm, average 11,88 mm.	12,5-13,5 mm, average 13,1 mm.
Tjisadane	11-12,5 mm, average 11,68 mm.	13,5-15 mm, average 14,16 mm.

When calculated from the tadpoles from all localities the average body-lengths are:

Rana limnocharis 11,78 mm.
Rana cancrivora 13,77 mm.

f. Tadpoles with hindlegs up to 4 mm.
Body-length of:

	Rana limnocharis.	*Rana cancrivora.*
Tanah Sereal	10-11,5 mm, average 10,5 mm.	10-13 mm, average 11,2 mm.
Tjisadane	10,5-12 mm, average 11,33 mm.	12-13 mm, average 12,5 mm.

Average calculated from the body-length of all the tadpoles from different localities together:

Rana limnocharis 10,02 mm,
Rana cancrivora 11,84 mm.

In groups d. and e. the difference is not very striking. Probably this is due to the scantiness of the material of these stages and perhaps the limits of the classes are taken somewhat wide.

2°. A second distinctive character can be found in the relative length of the series of teeth on the lower lip. ANNANDALE (1918) states that the third row of teeth on the lower lip is longer in *R. cancrivora* than in *R. limnocharis.* The 2nd table shows for a number of tadpoles of both species, which percentage has the third series of teeth longer than, equal to or shorter than half the length of the second row.

TABLE II.

Locality	*Rana cancrivora.*				*Rana limnocharis.*			
	Total number	Number of tadpoles where the 3rd series of teeth compared to 1/2 of the 2nd row is:			Total number	Number of tadpoles where the 3rd series compared to 1/2 of the 2nd series is:		
		shorter	equal	longer		shorter	equal	longer
Tanah Sereal	17	1	—	16	40	18	14	8
Tjisadane	3	—	—	3	60	28	19	13
Tjisadane	7	2	—	5	18	6	3	9
Tjisadane	7	—	1	6	19	8	6	5
Tjisadane	4	—	—	4	10	5	4	1
Tjisadane	2	—	—	2	13	8	2	3
Tjihoerang	2	—	—	2	6	2	3	1
Tanah Sereal	1	—	1	—	9	4	2	3
Tanah Sereal	10	—	1	9				
Babekon	6	5	1	—				
	59	8	4	47	175	79	53	43

The result is that *R. limnocharis* is much more variable in this respects than *R. cancrivora.* Generally nearly half of the number of tadpoles of this species has the third series shorter than half the length of the second row; often a nearly equal number has the third series equal to half of the second row and there are always some with a dentition of the *cancrivora*-type.

Rana cancrivora generally has the third row of teeth longer than half the length of the second series. In total out of 59 tadpoles of *R. cancrivora* 47 had the long third row of teeth, which consequently can be considered as giving at least some indication as to the identity of the tadpole under consideration.

3°. As a rule the tadpoles of *R. cancrivora* are less strongly pigmented and more uniformely coloured than those of *R. limnocharis,* especially in the distal half of the tail. Moreover *R. limnocharis* has a series of dark spots along the dorsal margin of the muscular portion of the tail, which is hardly discernible or entirely absent in *R. cancrivora.*

ANNANDALE (1918) mentions the shorter and blunter tail of *R. cancrivora* as a difference with *R. limnocharis.* As a matter of fact at first sight the tail seems shorter indeed, but the measurements in the table do not confirm this. In larvae of the same total length, the tail-length varies within the same limits round the same average. Perhaps the tail of *R. cancrivora* is a trifle deeper.

The blunter tip of the tail is a character that as often as not holds good.

Rana macrodon KUHL.

Rana macrodon FLOWER, 1899; BOULENGER, 1912; BOULENGER, 1920 and 1920 a; SMITH, 1922; VAN KAMPEN, 1923; PARKER, 1925; SMITH, 1925 a; SMITH, 1926.

L o c a l i t i e s: Djolok near Tjibodas — one tadpole.
Tjiapoes on the Salak — one tadpole.

H a b i t a t: a pond (Djolok).

T i m e: January and July.

O c c a s i o n a l c o m p a n i o n s: larvae of *Rana limnocharis* and *R. chalconota, Megalophrys hasselti* and *Rhacophorus reinwardti.*

The identification of these tadpoles is not beyond doubt. FLOWER's original description (1899) tallies fairly well with their outward appearance, but still there are some differences. As FLOWER's description, which is cited again and again in literature, seems to be the only available information (I at least have not been able to find further data) and as I have no identified specimens to compare these tadpoles with, it is impossible to decide, whether these differences are specific or whether they can be explained by variability. The tadpoles differ from FLOWER's description in the following points:

1°. the upper lip has only one series of teeth; FLOWER mentions a second broadly interrupted row.

2°. beak rather narrowly edged with black, not broadly.

3°. upper crest of the tail somewhat less convex; tip of the tail less acutely pointed (but perhaps it has been damaged).

4°. spiraculum equally distant from the end of the snout and from the anus; according to FLOWER it is nearer to the vent, but it seems to me that FLOWER's figure of the tadpole in this respect tallies better with my specimens than with his own description.

Rana kuhli SCHLEG.

Rana conspicillata GÜNTHER, 1872.

Rana kuhli SMITH, 1917; BOULENGER, 1920 and 1920 a; VAN KAMPEN, 1923; SMITH, 1925 and 1925 a; OKADA, 1926.

L o c a l i t i e s: Buitenzorg (Botan. Garden) — tadpoles.
Tjibodas and environs (Kemang, Tjihoerang, Rarahan, Goenoeng batoe) — frogs and tadpoles.
Tjibeureum — frogs and tadpoles.

These tadpoles were caught in December and January, April and May in slowly running water or the quieter parts of faster streamlets, occasionally also in ponds. Tadpoles of *Megalophrys hasselti* and *Meg. montana, Bufo cruentatus* and *B. melanostictus* (or *B. biporcatus*), *Microhyla achatina, Rana chalconota, R. nicobariensis* and *Rhacophorus javanus* were sometimes found in their company. The outward appearance of these tadpoles tallies nearly completely with SMITH's description and figures (1917), only the mouth shows some slight differences, viz.:

1°. the second series of teeth on the upper lip is continuous (SMITH: broadly interrupted).

2°. on the lower lip the second series is much shorter than the first and

the third attains only one-third of the length of the second row (SMITH: "the lowest row about half the length of the first or second, which are subequal").

As regards the coloration young tadpoles often have darker and more definitely outlined spots or cross bars on the tail than older larvae.

Rana microdisca BOETTGER.

Rana microdisca BOETTGER, 1892; BOULENGER, 1920; VAN KAMPEN, 1923.

Locality: Tjibodas — one frog and some tadpoles.

In April a young frog was collected, which belongs without doubt to *Rana microdisca*. As its hindlegs agree in every detail (disks, web and coloration) with those of a fullgrown fourlegged tadpole, this and some similar but younger larvae consequently belong to *Rana microdisca*. The tadpoles were collected in December.

Description: (fig. 6).

Body: its length about one a half times its breadth; regularly oval in younger tadpoles, in older ones the hinder part rather broader than the front.

Eyes: superior, looking obliquely in front and upward; nearer to the tip of the snout than to the spiraculum. Interorbital space more than one and a half times to nearly twice the distance between the nostrils.

Nostrils: equally distant from the eyes and the tip of the snout, rather wide apart (± 2 mm).

Spiraculum: sinistral, somewhat nearer to the end of the snout than to the vent.

Anus: dextral, close to the lower border of the ventral crest at the end of a rather long and wide tube.

Mouth: (fig. 7) ventral, narrower than the interorbital space; papillae in a single series along the sides and the lower lip (in young larvae sometimes with a narrow interruption in the middle).

Teeth: $\frac{1 \;\; 1{:}1}{1{:}1 \;\; 2}$. The second series on the upper lip is broadly interrupted. On the lower lip the uppermost series is the longest and has a narrow gap in the middle. The lowest row is about half as long as the second series.

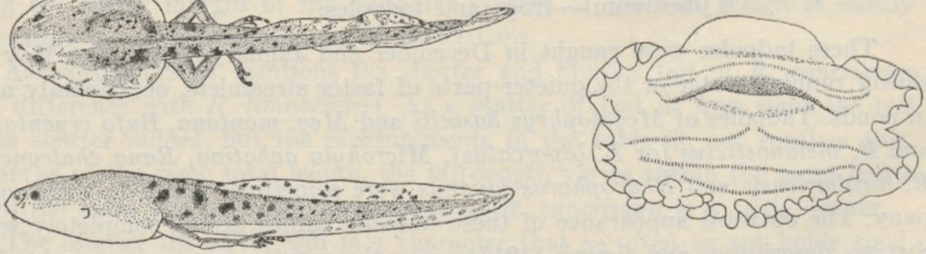

Fig. 6 & 7. Tadpole and mouth of the tadpole of *Rana microdisca*.

Jaws: edged with black and finely serrate.

Tail: nearly two and a half times the length of the body and four to five times as long as broad; tip blunt but not broadly rounded; crests narrow, the

ventral nearly straight, the dorsal convex and somewhat deeper but at a little distance from the body suddenly decreasing to a low ridge.

Colour: back and sides of the body and muscular portion of the tail light brown with dark brown spots and speckles, which are largest near the root of the tail and very small on the body. Dorsal crest and distal third part of the ventral crest also spotted; belly and proximal part of the ventral crest colourless.

Dimensions: total length: 33-37,5 mm.
length of body: 10,5-13 mm.
breadth of body: 6-8,5 mm.
length of tail: 22-26,5 mm.
depth of tail: 4-5 mm.

The actual measurements were:

Total length	Length of body	Breadth of body	Length of tail	Depth of tail
37 mm	11,5 mm	8,5 mm	26,5 mm	5 mm
37 „	11,5 „	8,5 „	26 „	5 „
34 „	11,5 „	7 „	23 „	4,5 „
34,5 „	10,5 „	7 „	24 „	4 „
33 „	12 „	7 „	22 „	5 „
37,5 „	13 „	6 „	24,5 „	5 „

The last is a tadpole with four well developed legs.

The larva of *Rana microdisca* resembles that of *R. kuhli* in general type, but differs from it by the characteristical spots on the skin and the sudden decrement of the dorsal crest, which in *R. kuhli* retains its full depth up to the root of the tail.

Rana jerboa (GTHR.).

"Unbestimmbare Froschlarve" WEBER, 1898.

Rana jerboa VAN KAMPEN, 1907 and 1909; BOULENGER, 1920 and 1920 a; VAN KAMPEN, 1923; SMITH, 1925 a.

Localities: Tjibeureum — frogs.
Tjibodas — tadpoles.
Java — tadpoles collected by Mr. P. A. OUWENS.

The frogs were caught in December and January in woods, where *Megalophrys montana, Microhyla palmipes* and *Philautus aurifasciatus* likewise occured; the tadpoles in December in swiftly running water together with the larvae of *Megalophrys montana.*

The skin of the tadpoles shows several white dots, which in microscopical sections appear to be glands like those composing the granular patches on the skin of the tadpoles of *Rana chalconota* (ANNANDALE 1917). The largest group of these glands is found at some distance from the eye, surrounding it on its caudal and ventral sides and the foremost scattered dots of the right and left groups nearly meet each other on the tip of the snout. Another small group of three or four glands lies dorsally just in front of the eye and yet another

fairly large group is found on the sides of the body in front of the root of the tail. Finally on the ventral surface three or four glands lie on either side in front of the hindlegs.

On the tail a series of similar glands occurs at the base of both crests on the border of the muscular portion. Here each white gland is bordered with black or darkbrown pigment. The distal third part of the tail is free from them.

Rana chalconota (SCHLEG.).

Rana labialis [1]) BOULENGER, 1887; FLOWER, 1896; ANNANDALE, 1917.

Rana chalconota VAN KAMPEN, 1907 and 1909; BOULENGER, 1920; SMITH, 1922; SMITH, 1925 a and 1926.

Rana chalconota and *R. labialis* VAN KAMPEN, 1923.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiomas and Tjitajam) — 3 frogs and many tadpoles.
Tjibodas and neighbourhood (Kemang, Rarahan, Goenoeng poetri, Goenoeng batoe, Tjihoerang, Djember, Tjisaroea, Telaga Warna, Gegerbintang and Gadog near Tjipanas) — tadpoles.
Tjiapoes on the slope of Mt. Salak — tadpoles.

A great many tadpoles of several different sizes were collected from the end of October till the end of January, in March, April and July in stagnant waters (sawahs, ponds and pools and a crater-lake near Gegerbintang) sometimes together with the larvae of *Bufo parvus* and *B. biporcatus*, *Microhyla achatina*, *Rana limnocharis*, *R. macrodon*, *R. kuhli*, *R. erythraea* and *R. nicobariensis*, *Rhacophorus leucomystax* and *Rhac. reinwardti*.

Rana erythraea (SCHLEG.).

Rana erythraea FLOWER, 1896; VAN KAMPEN, 1907 and 1909; BOULENGER, 1920; VAN KAMPEN 1923; PARKER, 1925; SMITH, 1925 a.

Localities: Buitenzorg, Botan. Garden — frogs.
Buitenzorg — tadpoles.
Tjitajam near Buitenzorg — tadpoles.

These tadpoles were collected in November in stagnant water (sawahs and a pond) once in company with the larvae of *Rana chalconota* and on another occasion with those of *Bufo melanostictus* (or *B. biporcatus*).

Rana nicobariensis (STOL.).

Rana javanica VAN KAMPEN, 1907 and 1909.

Rana nicobariensis BOULENGER, 1920 [2]) and 1920 a; VAN KAMPEN, 1923; SMITH, 1925 a.

Localities: Tjibodas and environs (Babekon, Goenoeng batoe, Gegerbintang, Djember and Tjadasgantoeng) — tadpoles.

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[1]) With BOULENGER and SMITH I consider *R. labialis* as a variety of *Rana chalconota*.

[2]) Not the tadpole.

Time: December and January.
Habitat: ponds, pools and sawahs.
Occasional companions: larvae of *Rana cancrivora, R. kuhli, R. chalconota* and *Bufo parvus.*

If there remained some slight doubt, whether the tadpoles described by VAN KAMPEN (1909) really belong to *R. nicobariensis,* this identity is now confirmed by a young frog (taken among the tadpoles) which agrees perfectly with the description of the species.

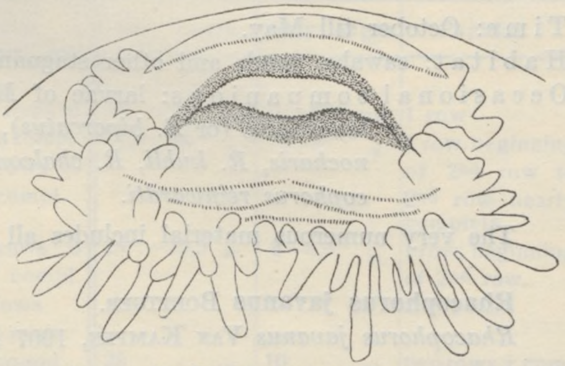

Fig. 8. Mouth of the tadpole of *Rana nicobariensis.*

Some of the tadpoles have a short third series of teeth on the lower lip in addition to the two rows mentioned in the original description. Out of fifty tadpoles thirty-five had three and fifteen two series of teeth on the lower lip (fig. 8).

Oœidozyga lima (KUHL) [1].

Oxyglossus lima BOULENGER, 1882; VAN KAMPEN, 1907 and 1909; BOULENGER, 1912; VAN KAMPEN, 1923.

Localities: Buitenzorg and environs (Tanah Sereal, Tjiliwoeng and Tjisadane) — frogs and tadpoles.
Time: October and December.
Habitat: sawahs.
Occasional companions: larvae of *Bufo melanostictus* (or *B. biporcatus*), *Rana limnocharis, R. cancrivora* and *Rhacophorus leucomystax.*

Contrary to BOULENGER's statement (1882 and 1912) some half grown frogs on examination of their shoulder-girdles appeared to have bony sterna (BOULENGER: "sternum a cartilaginous plate") [2].

Rhacophorus leucomystax (KUHL).

Rhacophorus leucomystax FLOWER, 1896 and 1899; VAN KAMPEN, 1907; ANNANDALE, 1912; BOULENGER, 1920 a; SMITH, 1922, 1925 a; VAN KAMPEN, 1923; PARKER, 1925; OKADA, 1926.

[1]) According to SMITH (1927) the generic name of *Oxyglossus* should be changed into *Oœidozyga.*

[2]) Further details have been published in the following paper: K. SCHIJFSMA, 1930. Das Brustbein von *Oœidozyga (Oxyglossus).* Tijdschr. Ned. Dierk. Ver. Ser. III, Dl. II.

L o c a l i t i e s: Buitenzorg and environs (Tanah Sereal, Tjiomas, Tjisadane and Tjitajam) — frogs and tadpoles.
Tjibodas and neighbourhood (Rarahan, Babekon, Koebang, foot of the Tjadasgantoeng) — frogs and tadpoles.
Telok Djambe near Krawang — tadpoles.

T i m e: October till May.

H a b i t a t: sawahs, ponds and other stagnant waters.

O c c a s i o n a l c o m p a n i o n s: larvae of *Megalophrys montana, Bufo melanostictus* (or *B. biporcatus*), *Microhyla achatina, Rana limnocharis, R. kuhli, R. chalconota, Oœidozyga lima* and *Rhacophorus reinwardti.*

The very numerous material includes all stages of development.

Rhacophorus javanus BOETTGER.
Rhacophorus javanus VAN KAMPEN, 1907 and 1909, 1923.

L o c a l i t i e s: Buitenzorg, Tjibodas, Tjibeureum, Goeha lalaj (a grotto near Tjibeureum) — tadpoles.

T i m e: November, December, January and April.

H a b i t a t: ditches and swamps, often with a rich vegetation; Goeha lalaj: deep dark water in a grotto.

TABLE III.

Rhacophorus javanus: proportional length of body and tail in:

Spotted tadpoles			Spotless tadpoles		
Tot. length	Body-length	Tail-length	Tot. length	Body-length	Tail-length
17 - 18 mm	5 — 6 mm	12—13 mm			
19 „	5,5 – 6 „	13—13,5 „	20 —21 mm		
20 —21 „	7 — 7,5 „	13 14 „	21,5—23 „	7 mm	13.5—14.5 mm
21,5 - 23 „	8 — 9 „	14—15 „	23,5—24,5 „	7—8 „	14,5—16,5 „
23,5 - 24,5 „	8,5 – 9,5 „	15—15,5 „	25 —25,5 „	8 – 8,5 „	16 „
25 —25,5 „	9 — 9,5 „	16 16,5 „	27,5 „	8—8,5 „	16,5 – 17,5 „
26 – 27,5 „	10 „	17 - 17,5 „	28 „		
28 —29 „	11 —12 „	17—18,5 „		10 „	18 „

O c c a s i o n a l c o m p a n i o n s: larvae of *Megalophrys montana, Bufo cruentatus, Microhyla palmipes, Microhyla achatina* and *Rana kuhli.*

Among the spotted tadpoles, which agree in every particular with the original description, there are always some uniformely coloured greyish brown or brown individuals. As in older tadpoles the absence of spots is the only dif-

Correctie.

p. 66:

TABLE III.

Rhacophorus javanus: proportional length of body and tail in:

Spotted tadpoles			Spotless tadpoles		
Tot. length	Body-length	Tail-length	Tot. length	Body-length	Tail-length
17 —18 mm	5 — 6 mm	12—13 mm			
19 ,,	5,5— 6 ,,	13—13,5 ,,			
20 —21 ,,	7 — 7,5 ,,	13—14 ,,	20 —21 mm	7 mm	13,5—14,5 mm
21,5—23 ,,	8 — 9 ,,	14—15 ,,	21,5—23 ,,	7—8 ,,	14,5—16,5 ,,
23,5—24,5 ,,	8,5— 9,5 ,,	15—15,5 ,,	23,5—24,5 ,,	8—8,5 ,,	16 ,,
25 —25,5 ,,	9 — 9,5 ,,	16—16,5 ,,	25 —25,5 ,,	8—8,5 ,,	16,5—17,5 ,,
26 —27,5 ,,	10 ,,	17—17,5 ,,	27,5 ,,	10 ,,	18 ,,
28 —29 ,,	11 —12 ,,	17—18,5 ,,	28 ,,	10 ,,	18 ,,

p. 126: Map of Togian Islands; the scale is 1 : 300.000.

TABLE IV.

Rhacophorus javanus: development of papillae along the lower lip in:

Spotted tadpoles			Spotless tadpoles		
Tot. length	Body-length	Papillae	Tot. length	Body-length	Papillae
17–18 mm	5 6 mm	1 row			
20–21 „	7,5–8 „	nearly 2 rows to two rows compl.	19 –22 mm	6–7,5 mm	1 row
			21,5–24 „	7–8 „	1 row; beginning of 2nd row to 2nd row nearly complete.
22–23,5 „	8 –9 „	2 –2½ rows to 3 rows compl.			
24–25,5 „	9 –9,5 „	2–2½ rows 3 rows ± compl. 3–3½ rows	24 –25,5 „	8–8,5 „	1 row; beginning of 2nd row.
27–29 „	10 –12 „	nearly 3 rows 3 rows compl. 3 to nearly 4 rows	28 „	10 „	two rows ± complete, beginning of 3rd row.

ference with the normal larvae, and as there is in some cases a perfectly gradual transition from spotted to uniformely coloured tadpoles, both types can be considered as belonging to *Rhacophorus javanus.*

At an earlier age the spotless tadpoles differ in some respects from the spotted individuals, viz., their tails are somewhat longer in proportion to the length of the body and have a slightly different form. In spotless larvae the lower margin of the tail is straight and consequently the tip is turned downward; whereas in spotted tadpoles, both crests being slightly convex, the tip points backward. When the tadpoles have attained a length of ± 30 mm the differences have all but disappeared.

Another point in which spotted and spotless tadpoles are different from each other, is the development of the papillae along the lower lip. In very young tadpoles the papillae of the first series appear all practically at the same time, often leaving a narrow gap in the middle. Then the second row is formed, the papillae appearing one after the other from the corners of the mouth to the middle until the whole series is doubled.

Often the third series begins its development before the second row is completed and a fourth before the third is finished.

Now, if spotted and spotless tadpoles of the same total length are compared in this respect (table IV), it appears that in spotted larvae the development of the series of papillae has more advanced than in spotless tadpoles. Spotted larvae of 20 to 21 mm are equal in this respect to spotless tadpoles of 22-24 mm, about half of the second row being developed by that time.

On comparing tadpoles of the same body-length the difference is less striking but still sufficiently apparent. Spotless larvae with a body-length of 7 to 7,5

mm have only one series of papillae, sometimes near the corners of the mouth some papillae of the second row begin to develop. Spotted tadpoles of the same body-length have the second series complete or all but accomplished. In larvae with a body-length of 8 mm the second row is not yet complete when they belong to the spotless types, whereas in spotted larvae of that size the third row is already developing.

The result in both cases is the same, fullgrown tadpoles of either type having a thick at least quadruple series of papillae along the lower lip.

The tadpoles of *Rh. javanus* closely resemble those of *Rh. reinwardti;* in fact the only distinctive character is furnished by the spots on the muscular portion of the tail. Consequently the uniformely coloured individuals of *Rh. javanus* are all but indistinguishable from *Rh. reinwardti.* Yet there are some very slight differences, which are visible but not easily formulated.

1°. The papillae along the lower lip are placed in three to four thick-set rows in *Rh. javanus.* In *Rh. reinwardti* there at most three rows, often in the middle only two. To my eye the papillae in *Rh. reinwardti* seem shorter and more regularly placed than those of *Rh. javanus.*

As for the development of the papillae *Rh. reinwardti* is intermediate between the spotted and the spotless larvae: tadpoles measuring 21-24 mm with a body-length of 8-9 mm have the second series of papillae nearly complete.

2°. The form of the body is regularly elliptical in *Rh. javanus,* whereas in *Rh. reinwardti* it is a rectangle with rounded angles.

3°. The tail of *Rh. reinwardti* is slightly shorter than that of spotless tadpoles of *Rh. javanus;* the proportions of tail- and body-length are the same as in the spotted larvae.

4°. The skin in *Rh. reinwardti* is transparent and of a light greyish yellow colour whereas in *Rh. javanus* it is brown or greyish brown and hardly transparent.

Rhacophorus reinwardti (BOIE).
Rhacophorus reinwardti VAN KAMPEN, 1909 and 1923.

Localities: Buitenzorg (Botan. Garden) — a frog and tadpoles.
Tjiomas near Buitenzorg — tadpoles.
Tjiapoes on the slope of the Mt. Salak — tadpoles.
Tjibodas — a young frog.

Time: December and January, March, April and the end of July.

Habitat: ponds and other stagnant water.

Occasional companions: larvae of *Microhyla achatina, Rana limnocharis, Rana chalconota* and *Rhacophorus leucomystax.*

Philautus aurifasciatus (SCHLEG.).
Ixalus aurifasciatus BOULENGER, 1882; VAN KAMPEN, 1907; ANNANDALE, 1917 a.
Philautus aurifasciatus VAN KAMPEN, 1923.

Localities: Buitenzorg, Tjibodas, Tjibeureum — frogs.
Time: December, January and March.
Habitat: woods.

Occasional companions: *Megalophrys montana, Microhyla palmipes* and *Rana jerboa* (metamorphosed).

GENERAL CONCLUSIONS.

This collection includes twenty-two out of the thirty-seven species of Anura known from Java (as mentioned by VAN KAMPEN, 1923), [1]) most of them as tadpoles. The tadpoles of *Bufo cruentatus, Microhyla palmipes* and *Rana microdisca* are described for the first time in this paper. As the three principal localities where the material was collected are situated at rather different elevations, which has a marked effect on the distribution of the species, it seems useful to arrange them in a table after the places, where they were found.

Buitenzorg and environs.	Tjibodas and neighbourhood 1247—1483 m.	Tjibeureum 1624 m.
	Megalophrys montana.	Megalophrys montana.
	Megalophrys hasselti.	
		Bufo cruentatus.
Bufo parvus.	Bufo parvus.	
Bufo melanostictus and B. biporcatus.	Bufo biporcatus.	
Microhyla achatina.	Microhyla achatina.	
Microhyla palmipes.	Microhyla palmipes.	Microhyla palmipes.
Rana limnocharis.	Rana limnocharis.	
Rana cancrivora.	Rana cancrivora.	
Rana kuhli.	Rana kuhli.	Rana kuhli.
	Rana macrodon.	
	Rana microdisca.	
	Rana jerboa.	Rana jerboa.
Rana chalconota.	Rana chalconota.	
Rana erythraea.		
	Rana nicobariensis.	
Oœidozyga lima.		
Rhacophorus leucomystax.	Rhacoporus leucomystax.	
Rhacophorus javanus.	Rhacophorus javanus.	Rhacophorus javanus.
Rhacophorus reinwardti.	Rhacophorus reinwardti.	
Philautus aurifasciatus.	Philautus aurifasciatus.	Philautus aurifasciatus.

The table shows, that only four species were found at all three localities, viz., *Microhyla palmipes, Rhacophorus javanus, Rana kuhli* and *Philautus aurifasciatus*. Three other species, *Bufo melanostictus, Rana erythraea* and *Oœidozyga lima* occurred at Buitenzorg (the lowest elevation) only and neither does literature record them from Tjibodas or Tjibeureum.

[1]) As I do not dispose of sufficient data to value AHL's records of species of *Hyla* and *Rhacophorus* from Java (1927 and 1929), I have not taken them into account.

The greatest number of species (17) was collected at Tjibodas, but many of them were also found at Buitenzorg, others at Tjibeureum. *Rana macrodon, Rana nicobariensis, Rana microdisca* and *Megalophrys hasselti* occured at Tjibodas only. In literature however *Rana nicobariensis* has been recorded from Batavia, which is situated slightly above sea-level. *Rana macrodon* was known to occur at Buitenzorg; Tjibodas and Tjiapoes on the slope of the Mt. Salak are new as javanese localities for this species.

APPENDIX.

Hylophorbus ocellatus (v. MÉHELY).

Metopostira ocellata v. MÉHELY, 1901; VAN KAMPEN, 1909 and 1914.

Hylophorbus ocellatus VAN KAMPEN, 1923.

Besides the javanese material the collection includes two frogs, which Mr. W. C. VAN HEURN found hidden under a stone on the island Ambon (Soja di Atas). I identified them as *Hylophorbus ocellatus,* because the original description tallies almost perfectly with their outward appearance and even the colour is the same as in MÉHELY's specimens (which had been preserved in the same fluid: formaline 4%). In the lumbar region the typical eyespot is still faintly discernible.

The few details in which these frogs differ from the original description can be explained by their youthful condition. They measure 22,5 and 24,5 mm from snout to vent, whereas MÉHELY mentions 33-42 mm as the length of his specimens. The differences are:

1°. the hindlegs are shorter; they reach only to the axil or to the tympanum.

2°. the tympanum is hidden. MÉHELY himself mentions this as a peculiarity of young frogs of this species.

3°. the skin is perfectly smooth.

Hitherto *Hylophorbus ocellatus* was known only from New Guinea, and Ambon is a new locality even for the genus, which includes only inhabitants of Australia, New Guinea and the Philippines, excepting *H. dubius,* which occurs on Halmahera. The two frogs under discussion certainly do not belong to *H. dubius.*

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HERPETOLOGISCHE NOTIZEN [1]).

Von

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V. Bungarus javanicus, eine neue Giftschlange von Java.

Im Juli 1931 erhielt ich von Herrn SOEDIRMAN, Arzt in Cheribon, eine Schlange zugesandt mit dem Ersuchen um Mitteilung, ob es sich in der Tat um eine Giftschlange handle. Dieses Reptil hatte in der Nacht vom 3. zum 4. Juli 2 Männer gebissen, welche bald nach dem Biss der Vergiftung erlagen. Diese Schlange erwies sich als eine neue Art, die aber sehr selten zu sein scheint, da sie auch der Bevölkerung des Fundortes unbekannt war. Beginn August hatte ich Gelegenheit, an Ort und Stelle nähere Erkundigungen einzuziehen und erfuhr nun die Einzelheiten über den Unfall.

Dem mündlichen Bericht der Augenzeugen zufolge spielte sich der Unfall auf folgende Weise ab. 3 Männer schliefen, wie dies während der Reisernte üblich ist, auf dem Felde in einer kleinen, provisorischen Hütte. SADJOEM, ein Mann von 30 Jahren, fühlte um 11 Uhr nachts eine Schlange über seine Hand kriechen und erhielt beim Erwachen, wahrscheinlich infolge einer hastigen Bewegung, einen Biss in den linken Zeigefinger. Er rief "di gigit oelar!" (eine Schlange hat mich gebissen) und schleuderte das Tier von sich. Unglücklicherweise fiel dieses auf seinen 50 jährigen Vater Pa MOERNI, welcher einen Biss in die linke Wade nahe der Kniekehle erhielt. Unmittelbar nach dem Biss stellte sich bei beiden schwerste Atemnot ein. Keiner von ihnen konnte sich erheben, um nach Hause zu gehen. Der dritte Mann, der mit auf dem Felde schlief, tötete die Schlange und lief ins nahe Dorf, um Hilfe zu holen. Man trug die beiden Verletzten fort, doch starb Pa MOERNI noch unterwegs, ungefähr eine ½ Stunde nach dem Biss. Sein Sohn lebte bis 3 Uhr mittags, also etwa noch 16 Stunden. Merkwürdig war die völlige Unfähigkeit der Gebissenen zu sprechen; nach dem Ausruf "di gigit oelar" konnte SADJOEM kein einziges Wort mehr hervorbringen und auch sein Vater vermochte nicht mehr zu sprechen. Sie sollen bloss auf den Hals gewiesen haben mit der bezeichnenden Geste grösster Atemnot.

Herr SOEDIRMAN, der die Leichen am 6. Juli morgens untersuchte, fand nichts anderes, als die kleinen, wenig auffallenden Bisswunden an den beschriebenen Stellen. Schwellung oder andere Veränderungen fehlten.

Die Unfallstelle, welche ich einen Monat später besuchen konnte, war die typische javanische Reisfeldlandschaft, nur dass nun die Ernte bereits vorbei war und daher an Stelle der nassen, grünen Felder, trockene, abgeerntete Terrassen vor mir lagen. Das Dorf Matanghadji, wo sich der Unfall ereignete

[1]) Cfr. Treubia. Vol. X, p. 467; Vol. XI, p. 301; Vol. XII, p. 273; Vol. XIII, p. 1.

(Distrikt Ploembon), liegt an Javas Nordküste, etwa 20 km südlich von Cheribon und ± 100 m hoch. Die offene Schutzhütte aus Matten und Palmblättern lag zwischen grossen Steinen neben einem kleinen Bewässerungsgraben, aus welchem die Schlange gekommen sein soll. Das Landschaftsbild entspricht völlig dem Lieblingsaufenthaltsort von *Bungarus candidus,* die sich auch meist in der Nähe von solchen Kanälen, oder auf den "galengans", den Grenzwällen zwischen den nassen Reisfeldern, aufhält.

Ich konnte etwa 20 Männer, welche bei dem Kranken und Toten die Nacht verbracht hatten, sprechen. Sie alle erklärten, dass sie diese Schlange niemals zuvor gesehen hätten; niemand im Dorfe kannte sie, doch entspräche sie einer Schlange, die "oraj warakas" oder "oraj lanang soelangkar" heisse.

Obgleich es im Allgemeinen richtiger ist, keine neue Art auf Grund eines einzigen Individuums aufzustellen, so scheint mir in diesem Falle eine Ausnahme doch gerechtfertigt. Wohl bietet die morphologische Beschreibung *eines* Tieres keine sicheren Anhaltspunkte, da es nicht feststeht, welches der gefundenen Merkmale konstant ist. Die Zeichnung jedoch ist vollkommen von der nächst verwandten Art, *B. candidus,* verschieden, von welcher ich in den letzten Jahren gewiss 200 Exemplare sehen konnte; und da auch bisher trotz sehr hoher Praemien auf demselben Fundort keine weiteren Exemplare zu erhalten waren, schien mir längeres Zuwarten weinig zu versprechen.

Noch von einem anderen Standpunkt aus ist dieser Fund belangreich. Wir kennen eine sehr markante und gefährliche Giftschlange, *Vipera russelli,* vom Indo-Australischen Archipel bisher mit Sicherheit bloss von den Inseln Komodo und Endeh. In der alten Literatur wird sie noch von Sumatra und Java (mit einem Fragezeichen) genannt, doch besitzt kein einziges Museum sichere Stücke von diesen Fundorten. Wir sehen nun in dem Fund dieser neuen *Bungarus*-Art, dass immerhin die Möglichkeit besteht, dass auch eine gefährliche Giftschlange lange Zeit der Aufmerksamkeit entgehen kann.

Beschreibung der Type: ♀ aus Matanghadji (Soember, Cheribon, Java-Nordküste); 3.VII.1931. Gegenwärtig in eigener Sammlung (Pl. 2).

Rostrale breiter als hoch, von oben sichtbar; es berührt 6 Schilder u.zw. die ersten Supralabialia, die Nasalia und Internasalia. Nasale gross, geteilt, von 6 Schildern umgeben: dem Rostrale, dem 1. und 2. Supralabiale, dem Praeoculare, Praefrontale und Internasale. Sutur der Internasalia ½ so lang als jene der Praefrontalia. Diese berühren das Frontale, Supraoculare, Praeoculare, Nasale und Internasale. Sutur der Praefrontalia ⅔ der Länge des Frontale. Frontale ebensolang als der Abstand vom Rostrale, viel kleiner als die Parietalia; seine Länge ⅔ der Parietalsutur, von 6 Schildern umgeben u.zw. den beiden Praefrontalia, den Supraocularia und Parietalia. 1 Prae-, 2 Postocularia. Supraoculare ungefähr $^4/_5$ der Länge und ⅔ der Breite des Frontale. Temporalia 1 + 2; das vordere viel länger als breit; es bildet mit dem 5. und 6. Supralabiale eine Sutur. 7 Supralabialia; das 3. und 4. berührt das Auge; das 2. deutlich schmäler als das 1. und 3. 7 Infralabialia; die 3 ersten stehen mit

dem vorderen Kinnschild in Kontakt. Das erste Infralabialpaar berührt sich hinter dem Mentale. Sutur des ersten Kinnschildpaares 3 mal so lang als jene des zweiten. Das erste Kinnschildpaar berührt die ersten 3 Infralabialia, das 2. nur das 4. Infralabiale; dieses ist das grösste in der Reihe. Das 1. Ventrale schliesst direkt an das 2. Paar Kinnschilder an. Ventralia 210. Anale nicht geteilt. Subcaudalia nicht paarig, 46. Schuppen in 15 Reihen (1 Schädellänge hinter dem Kopf, vor dem Beginn der vergrösserten Vertebralschuppen 16 Reihen). Vertebrale Schuppen stark vergrössert, hexagonal, doppelt so breit wie die seitlichen Schuppen, in der Körpermitte breiter als lang, breiter als die Länge der seitlich angrenzenden Schuppen. Lateralwärts nehmen die Schuppen an Breite zu; die letzte Schuppenreihe nahezu doppelt so breit als die 1. neben den Vertebralschuppen.

Länge 860 mm; Schwanz 114 mm. Rücken nicht kantig; Körper rund, nicht seitlich zusammengedrückt; Schwanz allmählich zugespitzt, rund.

Während die Kopfschilder, wie bei den allermeisten Bungarusarten, nicht zur sicheren Unterscheidung der Art herangezogen werden können, ist die Zeichnung sehr deutlich, wenigstens von allen Bungarus-Arten des Archipels, verschieden. Die Oberseite von Kopf, Hals und Schwanz is blauschwarz. Die Supralabialia sind weisslich, zum Teil mit verwaschenen, dünkleren Flecken. Die grossen Vertebralschuppen im vorderen Drittel mit kleinen, weissen Flecken am Vorder- und Hinterrand. Caudalwärts werden diese lichten Flecke zunehmend grösser; etwa von der Körpermitte an bis zur Schwanzwurzel umrahmt ein weisser Rand die Vertebralschuppen, die hier nur mehr im Zentrum einen blauschwarzen Fleck zeigen. Die Schuppen der beiden letzten, seitlichen Reihen [in der Körpermitte jene der 3 letzten Reihen] oben und unten mit weisslichen Ecken, wodurch schmale, undeutliche, helle Längslinien angedeutet werden. Auf der Körpermitte tragen die meisten Schuppen kleine, in der Längsrichtung angeordnete Randflecke.

Unterseite (im Alkohol) einfärbig weisslich; alle Ventralia seitlich mit dunklen Flecken. Ventralseite des Schwanzes im letzten Drittel dunkel bleigrau. *Im Leben sollen alle weisslichen Partien leuchtend gelb gewesen sein (wie Curcuma)!*

Iris von derselben blauschwarzen Farbe als der Kopf.

Pholidosisch stimmt *Bungarus javanicus* in hohem Masse mit *Bungarus candidus* überein. Da vorläufig bloss 1 Exemplar zur Untersuchung vorliegt, lässt sich nicht feststellen, welches der morphologischen Merkmale konstant ist und zur Unterscheidung der Art fixiert werden kann. In Bezug auf die Zeichnung jedoch unterscheidet sie sich auf den ersten Blick von den ± 200 *Bungarus*, welche ich auf Java sehen konnte. Von den Arten des süd- und ostasiatischen Festlandes scheint sie am nächsten mit *Bungarus niger* von Assam verwandt zu sein, wie die folgende Tabelle WALL's [1]) demonstriert:

*) F. WALL "The poisonous terrestrial snakes of our British Indian Dominions...." Bombay Natural History Society. 1917; pag. 13. In diese Tabelle wurde auch noch *Bungarus wanghaotingi* POPE (Amer. Mus. Novitates. Nr. 325; 1928; pag. 3) aufgenommen, so dass wir gegenwärtig 14 *Bungarus*-Arten kennen.

Scheme for Identification of the Kraits.

Name of species	Costals: 2 headlengths behind the head	Costals: Midbody	Costals: 2 headlengths before the anus	Vertebrals in mid-body broader than long	Ventrals	Subcaudals	Some subcaudals divided at tine of tail	2nd supralabial decidedly narrower than 3rd	Body compressed	Number of bands or bars on body	Number of bands or bars on tail	Habitat
flaviceps . .	13	13	13	yes	193-226	42-54	yes	?	?	None		Tenasserim, Cochin China, Malay Peninsula and Archipelago.
bungaroides . .	15	15	15	yes	220-237	44-51	yes	yes	no	Many equidistant white chevrons or lines.		Eastern Himalaya, Khasi Hills, Cachar.
lividus	15	15	15	no	209-215	35-42	no	yes	no	None		Brahmaputra Basin, South of Himalayas.
caeruleus . . .	15	15	15	yes	200-218	38-50	no	no	no	Many white lines in pairs.		Indus Basin, Ganges Basin, Peninsula India and Ceylon.
ceylonicus . .	15	15	15	yes	219-235	32-40	no	yes	no	15 to 20 Complete white bands.	2 to 5	Ceylon.
fasciatus . . .	15	15	15	yes	200-234	23-39	no	yes	no	16 to 27 Complete yellow bands.	2 to 5	Brahmaputra Basin, South of Himalayas, Mahanadi Basin, Irrawaddy Basin, Tenasserim, Indo-China, South China, Malay Peninsula and Archipelago.
magnimaculatus	15	15	15	yes	218-229	42-49	no	yes	no	11 to 14 White bands incomplete ventrally.	2 to 3	Irrawaddy Basin.
multicinctus . .	15	15	15	yes	194-218	45-53	no	yes	no	31 to 48 White bands incomplete ventrally.	11 to 13	Lower Brahmaputra Basin, Irrawaddy Basin, Andamans, South China to Formosa.
niger	15	15	15	yes	216-231	47-57	no	yes	no	None		Brahmaputra Basin, South of Himalayas.

Nama of species	Costals				Ventrals	Subcaudals	Some subcaudals divided at tipe of tail	2nd supralabial decidedly narrower than 3rd	Body compressed	Number of bands or bars on body	Number of bands or bars on tail	Habitat
	2 headlengths behind the head	Midbody	2 headlengths before the anus	Vertebrals in midbody broader than long								
sindanus . . .	17	17 or 19	17	yes	201-237	43-52	no	no	no	Many white lines in pairs.		Rajputana, Sind, Baluchistan, Punjab.
walli	17 or 19	17 or 19	17	yes	192-207	46-55	no	yes	yes	Many equidistant white beaded lines.		Ganges Basin.
candidus . . .	15	15	15	yes	210-222	40-50	no	?	no	20 to 25 White bands incomplete ventrally.	7 to 9	Malay Peninsula and Archipelago.
wanghaotingi .	15	15	15	?	225-228	47-53	no	?	?	22 to 23	10 to 11	Southwestern Yunnan Province, China.
javanicus . . .	15	15	15	yes	210	46	no	yes	no	None		Java.

DE ROOIJ's Angabe *), *Bungarus candidus* sei "...... or dark brown or bluish black above, with narrow, transverse, white streaks *or with small white spots,"* beruht sicherlich auf einen Irrtum; wenigstens für Java. Unter hunderten von *Bungarus candidus* sah ich keine einzige, welche *"schwarz mit weissen Flecken"* gewesen wäre. Ganz ausnahmslos zeigen alle javanischen Stücke vollkommen scharf das charakteristische, dunkel und licht quergebänderte Bild dieser Art. Sehr wahrscheinlich entnahm DE ROOIJ ihre Beschreibung BOULENGER's Catalogue of Snakes (III, pag. 369), wo BOULENGER *Bungarus candidus* var. *caeruleus* mit den Worten beschreibt: "Dark brown to bluishblack above, with narrow transverse white streaks, which may be disposed in pairs, *or with small white spots."* Wir wissen aber, das BOULENGER 3 verschiedene Arten als *B. candidus* vereinigte und dass er mit seiner oben gegebenen Beschreibung *B. caeruleus* meinte, deren Vorkommen auf Vorderindien und Ceylon beschränkt ist und die morphologisch gut von *Bungarus candidus* differenziert ist.

*) The Reptiles of the Indo-Australian Archipelago. II; p. 244.

VI. Weitere Beobachtungen über die Fortpflanzung West-Javanischer Reptilien.

In "Treubia", Vol. XI, Livr. 3, 1930 beschrieb ich die Eier einer Reihe von javanischen Reptilien. Im Anschluss daran seien hier weitere Beobachtungen über die Fortpflanzung westjavanischer Reptilien mitgeteilt.

Im ersten Bericht handelte es sich vorwiegend um Eier, welche in der Gefangenschaft abgelegt wurden und daher innerhalb der ersten 24 Stunden photographiert werden konnten. Die vorliegende Mitteilung enthält zum Teil Beschreibungen und Abbildungen von Eiern, welche im Freien gefunden [und erst nach dem Auskriechen der Jungen identifiziert] wurden. Sie geben daher nicht die ursprüngliche Form und Grösse der Eier an; denn diese nehmen, wie schon seinerzeit erwähnt, aus dem umgebenden Milieu Feuchtigkeit auf und vergrössern dadurch ihr Volumen wesentlich. Mit dem Imbibitionswasser nimmt die Eihülle auch Farbstoff auf, so dass die ursprünglich einfärbig weissen oder licht cremefarbigen Eier dunkle, wolkige Flecke aufweisen können. Soweit es bisnun feststeht, sind alle javanischen Reptilieneier einfärbig weiss. Da die bisher beobachteten Arten ihre Eier unterirdisch, in Rattenhöhlen, unter Steinen, faulendem Holz, in Felsspalten usw. ablegen, bedürfen sie keiner Schutzfärbung wie viele Vogeleier. Zum Vergleich mit der ursprünglichen Form, sind hier auch von einigen bereits früher dargestellten Arten imbibierte Eier abgebildet.

Alle Aufnahmen sind in natürlicher Grösse wiedergegeben. In der Nomenklatur folge ich aus Utilitätsgründen DE ROOIJ's "Reptiles of the Indo-Australian Archipelago".

OPHIDIA.

Tropidonotus piscator SCHN. (Fig. 1).

Ein im Juli 1930 in Bandoeng ($\pm$ 750 m) gefangenes, gestreiftes ♀ (Blgr. C) legte am 8. VIII ...... 46 Eier, welche zu zwei Packeten von 32, resp. 14 Stück miteinander verklebt waren. Die Eier waren blendend weiss, weichschalig und nicht so gespannt, wie Schlangeneier im allgemeinen sind. Sie massen 24 $\times$ 16, 25.5 $\times$ 18, 25 $\times$ 18, 27 $\times$ 18 und 26 $\times$ 17 mm.

Von den 32 Eiern (das Packet von 14 wurde konserviert) gingen 5 zugrunde. 26 kamen am 3. XI. (u.zw. alle innerhalb von $\pm$ 6 Stunden) und eines am 5. XI. aus. Von den 27 neugeborenen Schlangen waren 25 längsgestreift (Blgr. C) und 2 gross gefleckt (Blgr. B). Sie massen 165-185 mm. Die Entwicklung dauerte also $\pm$ 87 Tage.

Die bisnun erhaltenen Gelege bestanden aus 45, 40, 52, 18, 36, 37 und 46 Eiern.

Fig. 1 wurde aufgenommen, als die Eier 59 Tage alt waren. Im Vergleich mit Fig. 2 in "Herpetologische Notizen II" zeigt sich eine deutliche Grössenzunahme. Die ursprünglichen Dellen sind verschwunden und die Eier prall gefüllt.

Tropidonotus vittatus L.

Ein am 25.IV.-30 in Bandoeng gefangenes ♀ enthielt 5 noch nicht legereife Eier.

Am 14.II.-1931 fand Herr W. C. VAN HEURN in Garoet (± 700 m) 4 und am 21.II.....10 Eier dieser Art beisammen am Rand eines nassen Reisfeldes zwischen Baumwurzeln. Als ich mehrere davon am 25.III. messen konnte, massen sie 25 × 13, 26 × 13, 25 × 13, 25 × 13 und 26 × 12.5 mm. Ein Teil der Jungen kam am 26. und 27.III. aus und mass 164-174 mm.

Tropidonotus chrysargus SCHLEGEL. (Fig. 2).

Ende Juli 1930 erhielt ich aus Tjibodas (± 1400 m) 6 Eier (Fig. 2), welche 24 × 15, resp. 25 × 15 mm massen. 5 davon waren zu einem Klumpen verklebt. Alle 6 kamen am 2.IX. aus. Die neugeborenen Schlangen massen 175-185 mm.

Am 30.IX. legte ein ♀ aus Tjibodas 7 Eier: 25 × 15, 23 × 14, 24 × 15, 27 × 14,5, 24 × 15 und 25 × 15 mm. Diese waren zu je 4 und 3 Stück verklebt. Die Jungen kamen am 29. und 30.XI. aus massen 196 mm.

Ein anderes ♀ aus Tjibodas legte am 26.I.-31...4 Eier von 29 × 12, 31 × 11.5, 26 × 12.5 und 29 × 12 mm. Diese waren deutlich länger und schmäler als die vorgehenden und kamen am 26.III aus. Die Jungen mussen 176-195 mm.

Die Entwicklung dauerte in beiden Fällen genau 2 Monate. Die einfärbig weissen Eier besitzen eine dünne, weiche, pergamentartige Schale.

Naja tripudians sputatrix BOIE. (Fig. 3).

Am 17.XII.-30 fand Herr W. C. VAN HEURN bei Garoet in der Höhle einer Reisfeldratte (*Rattus rattus brevicaudatus*) 16 Eier von *N.tr.sp.* Das ♀ lag beim Gelege, so dass wir hier ein Beispiel von Brutpflege vor uns haben. Zu dieser Zeit enthielten die Eier bereits gut entwickelte Embryonen. Als ich am 11.I.-31 einige der Eier messen konnte (Fig. 3), stellte ich die folgenden Masse fest: 51 × 34, 53 × 33.5, 51 × 33 und 52 × 33 mm. Sie besassen eine dünne, weiche, schwach pergamentartige Schale. Von diesen Eiern kam am 13.III. eine Schlange aus, welche 284 mm lang war. Die junge *Naja* nahm schon, als sie noch zur Hälfte im Ei lag, die bekannte Abwehrstellung ein und zeigte auf dem Halse eine deutliche U Zeichnung.

Calamaria linnaei BOIE. (Fig. 4).

In der ersten Hälfte Juni-30 fand ich in Tjibodas beim Umgraben eines faulenden Grashaufens in 20-30 cm Tiefe unter der Erde zahreiche *C. linnaei* und mehrere Eier dieser Art, die einzeln verstreut in der Erde lagen. Sie kamen am 2.VII., 20.VII. und 2.VIII. aus.

Am 6.VII. legte ein ♀ aus Tjibodas 3 Eier von 20 × 8, 20.5 × 7.5 und 20.5 × 7.5 mm.

Ende Juli erhielt ich mehrere Eier aus Tjibodas, welche am 25.VIII., 31. VIII., 5.IX. und 8.IX. auskrochen. Die jungen Schlangen waren 92-120 mm lang.

Ein am 10.VI. in Tjibodas gefundenes Ei mass 18 × 11 mm (Fig. 4). Das Junge schlüpfte am 13.IX. aus und war 99 mm lang.

Während im Juli 1930 in Tjibodas unter den Komposthaufen viele *Calamaria*eier zu finden waren, fand ich im Februar-31 (mitten in der Regenzeit) nur ein einziges Ei, aber viele Schlangen. Auch die sonst häufigen Eier von *Lygosoma temmincki* waren jetzt selten.

Ein im Februar 1931 in Tjibodas gefangenes ♀ legte am 23.II. .....3 Eier von 29 × 9, 29 × 9 und 29 × 8.5 mm, welche unbefruchtet waren.

Zwei andere, am 23.II. gelegte Eier kamen am 18.V. aus.

Unbefruchtete Eier sind sogleich daran zu erkennen, dass sie stark von der gewöhnlichen Form abweichen. Ihre Schale ist weich und schlaff und sie gehen in 1-2 Tagen zugrunde.

Alle C. 1. aus Tjibodas gehörten zur var. B. Blgr.

Typhlops lineatus BOIE.

Am 10. Juni-30 fand ich in Tjibodas beim Umgraben der unter einem Komposthaufen liegenden Erdschichte in ± 20 cm Tiefe [zusammen mit zahlreichen Exemplaren von *Typhlops lineatus, Calamaria linnaei* und deren Eiern] 3 Eier von *Typhlops lineatus*. Bei 2 davon waren die Jungen eben beim Auskriechen; das 3. Ei war noch unversehrt. Die Schale war auffallend dünn, völlig durchsichtig und lag dem Foetus enge an. Das unversehrte Ei mass 24 × 7.5, die eben ausgekrochene Schlange 108 mm.

Lachesis gramineus SHAW.

Ein bei Pengalengan (± 1500 m) am 20. August 1930 gefangenes ♀ (welches stets allein in einem Terrarium lebte) gebar am 15.I.31......17 Junge, welche 235-265 mm massen. Die Gravidität dauerte also mindestens 5 Monate.

Ein ♀ aus der Umgebung von Indramajoe (West-Java, Nordküste) bekam am 5.XII.-30......11 Junge, welche 214-226 mm massen.

Fordonia leucobalia SCHLEGEL.

Im Februar 1930 hatte ich Gelegenheit, eine Reihe von *F. l.* zu sezieren; 4 ♀ enthielten weit entwickelte Embryonen u.zw. 3, 4, 4 und 5 Stück. Im Mai desselben Jahres fand ich auf demselben Fundort einige 20 cm lange Schlangen, deren offener Annulus umbilicalis davon zeugte, dass sie erst vor kurzem geboren wurden.

Psammodynastes pulverulentus BOIE.

Ein im Dezember 1928 bei Dajeuhmanggoeng (Garoet, ± 1000 m) gefangenes ♀ bekam am 2.I.-29......5 Junge, welche 148-151 mm lang waren.

Am 20. X. 1928 gebar ein anderes ♀ aus Dajeuhmanggoeng 5 Junge.

Im Juli-30 bekam ein ♀ aus Tjibodas 7 Junge.

Ein Ende Juli in Tjibodas gefangenes ♀ enthielt 7 Eier, in welchen makroskopisch noch keine embryonale Entwicklung zu erkennen war.

Ein am 3. August getötetes ♀ aus Tjibodas enthielt 7 gut entwickelte Embryonen.

Am 27. September bekam ein ♀ aus Tjibodas 7 Junge.

Ein anderes ♀ aus Tjibodas gebar am 25. Oktober 7 Junge, deren Länge 155-178 mm betrug.

Am 12. Februar 1931 fing ich in Tjibodas ein ♀, bei dessen Untersuchung 5 Embryonen festgestellt wurden.

Ein am 20. März 1931 bei Pengalengan gefangenes ♀ zeigte am 19. April bei der Obduktion 10 gut entwickelte Embryonen.

Dendrophis pictus GMEL. (Fig. 5).

In Ergänzung zur Abbildung 4 in "Herpetologische Notizen II" diene hier Fig. 5, welche zeigt, in welcher Form der Eizahn mitunter zahlreiche parallele Schnitte in die Eihaut schneidet.

LACERTILIA.

Ptychozoon homalocephalum CREV. (Fig. 6).

Im September 1930 erhielt ich aus Buitenzorg mehrere Tiere dieser Art, von denen je ein ♀ am I.X., 27.X., 31.X.-30, am 5.III. und 30.IV.-31 je 2 Eier legte. Jedes Eipaar ist fest miteinander verklebt, halbkugelförmig und besitzt eine kalkige, leicht brüchige Schale. Die Eier werden so an die Unterlage angeklebt, dass sie nicht unversehrt loszulösen sind. Die Masse betragen 13 $\times$ 9.5 und 14 $\times$ 10.5 mm. Alle 5 ♀ suchten dieselbe Ecke des Terrariums zur Eiablage auf. Diese Gewohnheit scheint bei Geckoniden mehr vorzukommen.

Die am 31.X.-30 gelegten Eier kamen am 2.III.-31, also nach mehr als 4 Monaten aus. Die Jungen besassen die Länge von 61 mm.

Gecko verticillatus LAUR. (Fig. 7).

Am 24.IV.-30 erhielt ich 3 Eier, welche am 12.IV. bei Loerangoen (Koeningan, $\pm$ 100 m) in Kalksteinspalten gefunden wurden. Es sollen 7 Stück beisammen auf dem Felsen geklebt sein. 2 Gecko's wurden bei den Eiern beobachtet. Beim Loslösen vom Gestein, auf welchem die Eier klebten, zerbrachen 4; diese enthielten gut erkennbare Embryonen.

Die halbkugelförmigen Eier massen: 21 $\times$ 16, 20 $\times$ 17 und 19 $\times$ 15 mm. Die Schale ist hart wie bei einem Vogelei, aber sehr spröde. Die Echsen kamen am 12. und 15.V. aus und waren 84 mm lang.

Hemidactylus frenatus D. & B.

Frisch ausgekrochene *H. fr.* beobachtete ich in Bandoeng im März, April, Mai, Juni, August und September 1930.

Hemiphyllodactylus typus BLEEKER.

Im Juni und Juli 1930 erhielt ich mehrere Eier dieser Art aus Tjibodas, welche zu je zweien miteinander verklebt waren. Alle Eier massen 8 $\times$ 6 mm. Mehrere davon krochen am 7.VIII., 24.X. und 26.X. aus. Die jungen Echsen waren 33-35.5 mm lang.

Gonyocephalus chamaeleontinus LAURENTI = *G. Kuhli* SCHLEGEL? (Fig. 8, 9, 10).

In "Herpetologische Notizen" II und III beschrieb ich ein ♀ von Kawah Kamodjan bei Garoet als *G. kuhli* SCHLEGEL. Inzwischen hatte ich Gelegenheit, ein reiches Material von *Gonyocephalus* aus der Umgebung von Tjibodas zu untersuchen und schliesse mich der Meinung DUNN's [1]) und BRONGERSMA's [2]), an, welche *G. kuhli* für ein Synonym von *G. chamaeleontinus* halten. Ich untersuchte in Tjibodas in ± 1350-1500 m Höhe ± 50 exemplare, die zweifellos einer einzigen Art angehörten, auf welche aber beide Artbeschreibung gut Anwendung finden. Später werde ich ausführlicher darüber berichten. Inzwischen will ich bloss meine Beobachtung über die Eier dieser Art mitteilen.

Ein ♀ vom Goenoeng Tiloe, Pengalengan (± 1700 m), legte am 20.VI.30...3 Eier.

Ein am 10.VI. bei Tjibodas gefangenes ♀ enthielt 6 legereife Eier.

Ein ♀ aus Tjibodas legte am 28.VI......3 und am 29. und 30.VI. noch je 1 Ei, welche am 25.X. auskamen. Die neugeborenen Echsen waren 80 mm lang. Die Entwicklung dauerte nahezu 4 Monate.

Ein anderes ♀ aus Tjibodas legte am 4.VII......4 Eier von 21 × 12, 21 × 11.5, 22 × 11.5 und 22 × 11.5 mm.

Ein weiteres ♀ aus Tjibodas legte am 20.VII......4 Eier.

Am 7.VIII. legte ein ♀ aus Tjibodas 5 Eier von 21 × 11.5, 21 × 11.5, 20 × 12, 21 × 12 und 21 × 11.5 mm.

Am 27.VIII. legte ein ♀ aus Tjibodas 3 Eier, von welchen 2 die abnormale Form und Grösse von 28 × 12 und 27 × 12 mm zeigten (Fig. 8).

2 am 14.VI. in Tjibodas gefundene Eier von 23 × 12 und 20 × 11 mm kamen am 22.IX aus. Die jungen Echsen massen 78 mm.

4 am 10.VI. in Tjibodas gefundene Eier (Fig. 9) massen zu dieser Zeit 21 × 11.5, 21 × 11.5, 21 × 11 und 21 × 11.5 mm. Zufolge der Imbibition wiesen die Eier [knapp vor dem Auskriechen] am 6.X. eine Länge von 27 und eine Dicke von 17 mm auf (Fig. 10). Die Spannung war hier so gross, dass die Eier beim ersten Schnitt des Eizahnes deutlich einsanken (Fig. 10, rechts).

Am 1.X. legte ein ♀ aus Tjibodas 2 abnormal kleine Eier von 14 × 7 und 14 × 7.5 mm. Am 30.XI. massen diese 19 × 11.5 mm.

Ein ♀ aus Tjibodas, das am 12.II-31 gefangen wurde, legte am 1.III......5 Eier von 20 × 11, 19 × 11, 20 × 11.5, 20 × 11 und 20 × 11 mm.

Ein anderes ♀ vom 12.II. legte am 7.IV......4 Eier von 22 × 11, 22 × 11.5, 23 × 11 und 21 × 11 mm.

4 am 11.II. gefundene Eier massen 18.5 × 10.5, 18.5 × 10.5, 17 × 10 und 17 × 10 mm.

Am 8.III. legte ein ♀ aus Tjibodas 4 Eier.

Die pergamentähnliche Eischale von *Gonyocephalus* ist fest und bei der Ablage der Eier blendend weiss. Die Dimensionen sind, wie wir zeigten, manch-

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*) Lizards from the East-Indies. American Museum Novitates. 288; 1927; pag. 4.
**) Notes on the list of reptiles of Java. Treubia. 1930; p. 300.

mal beträchtlichen Schwankungen unterworfen. Die auf Fig. 10 sichtbaren, parallelen Rillen sind der Ausdruck der starken Ausdehnung der Eihaut.

Tachydromus sexlineatus DAUD.

Ein bei Tjisoeroepan (± 1400 m) am 29.XII.-30 gefangenes ♀ legte am 6.I.1931......2 Eier von 11 × 7 und 10 × 7 mm. Die Eischale ist fest, pergamentartig.

Lygosoma sanctum D. & B.

Am 17.XII.1931 fand Dr. L. KALSHOVEN bei Bandjar in West-Java 2 Eier dieser Art im Nest der Termite *Nasutitermes* (*Eutermes*) *matangensiformis* HOLMGR.(?). Die Eier lagen (nach brieflicher Mitteilung des Herrn Dr. KALSHOVEN) im Randteil des Kartonnestes, nahe der Baumrinde und schienen vollkommen ummauert zu sein, ähnlich wie jene Eier von *Dipsadomorphus jaspideus* (Herpet. Mitteilungen I. Treubia X, 1929).

Die jungen Echsen kamen im Februar 1931 aus.

Lygosoma temmincki D. & B.

2 Eier, welche im Februar 1930 nahe dem Krater Kawah Kamodjan in ± 1600 m Höhe unter morschem Holz gefunden wurden, kamen am 25.III. aus und massen 37 mm.

Am 10.VI. fand ich bei Tjibodas mehrere Eier von *L.t.* unter faulendem Holz; diese kamen am 17.VII. und 7.VIII aus und massen 43-44 mm.

2 in Tjibodas gefangene ♀ legten am 16.VI......4 Eier von 10.5 × 5.5, 10.5 × 5, 11.5 × 5 und 11 × 5 mm.

Am 22.II.-31 legten 3 in Tjibodas gefangene ♀ je 2 Eier: 10 × 5.5, 10.5 × 5.5, 10 × 5, 10.5 × 5, 10 × 5.5 und 10.5 × 5 mm. Alle 6 Eier kamen am 19.IV. aus. Die Länge der jungen *L.t.* betrug 36-38 mm.

Am 23.II. legte ein ♀ aus Tjibodas 2 Eier.

Am 7.III. legt ein ♀ aus Tjibodas 2 Eier von 10 × 5.5 und 10.5 × 5.5 mm.

Die Eischale von *L.t.* ist fest pergamentartig.

Draco volans L.

Im Juli -30 erhielt ich 2 Eier dieser Art (VAN HEURN col.), welche in Garoet im Garten gefunden wurden. Die Echsen krochen am 13.VIII. aus und massen 66 und 70 mm.

Das *Draco*-Ei besitzt eine sachte, pergamentähnliche Schale.

Draco fimbriatus KUHL. (Fig. 11).

Ein bei Tomo (Cheribon) erbeutetes ♀ legte kurz nach dem Fang am 30. XII.1930......2 Eier. Das Tier scheint während der Eiablage gefangen worden zu sein, so dass wahrscheinlich einige Eier bereits abgelegt waren. Die beiden Eier massen 16 × 11 mm (Fig. 11). Am 23.II.-31 waren sie 28.5 × 14 mm gross. Die jungen Dracos krochen am 8.III. aus.

Calotes jubatus D. & B. (Fig. 13).

2 am 21.III.-30 bei Tjibodas gefundene Eier massen 40 × 10 und 40 × 10.5 mm, waren also beträchtlich kleiner als die bisher festgestellten Masse.

2 am 19.VI. in Bandoeng im Gras gefundene, frischgelegte Eier massen 44 × 10.5 und 45 × 12 mm. Diese kamen am 11.IX. aus. Kurz vor dem Auskriechen mass das grössere Ei 53 × 15 mm. Die junge *Calotes* war 162 mm lang. Auch dieses Bild zeigt im Vergleich mit Fig. 9 in Herpet. Not. II die wesentliche Formveränderung durch Imbibition.

2 am 4.IX. in Bandoeng im Gras gefundene Eier massen 43 × 9.5 mm. Die bisher in Bandoeng (700-750 m) und Tjibodas (± 1400 m) gefundenen Eier von *Calotes jubatus* waren deutlich kleiner als jene aus Tasikmalaja (± 350 m). Ihre Eischale ist fest, pergamentähnlich und blendend weiss.

Calotes tympanistriga GRAY. (Fig. 12).

Am 20.III.-30 fing ich bei Tjibodas 2 ♀ mit je 2 legereifen Eiern.

Am 17.VI. legte ein ♀ aus Tjibodas 2 Eier von 18 × 8 und 17.5 × 8 mm. Die jungen Echsen kamen am 27.VIII. aus und massen 76 mm.

Am 9.VI. fing ich in Tjibodas ein ♀, welches am 16.VII......2 Eier legte.

Am 18.VI. lengte ein ♀ aus Tjibodas 2 Eier von 16.5 × 8 mm, welche am 27.VIII. auskamen.

Am 29.XII. fing ich auf dem Papandajan (± 1700 m) ein ♀, welches am 3.I.-31......2 Eier legte von 18 × 8 und 17.5 × 7.5 mm. Am 23.II. massen diese 19 × 11 mm.

Die Eischale von *C.t.* ist stark, zähe und pergamentähnlich.

CHELONIA.

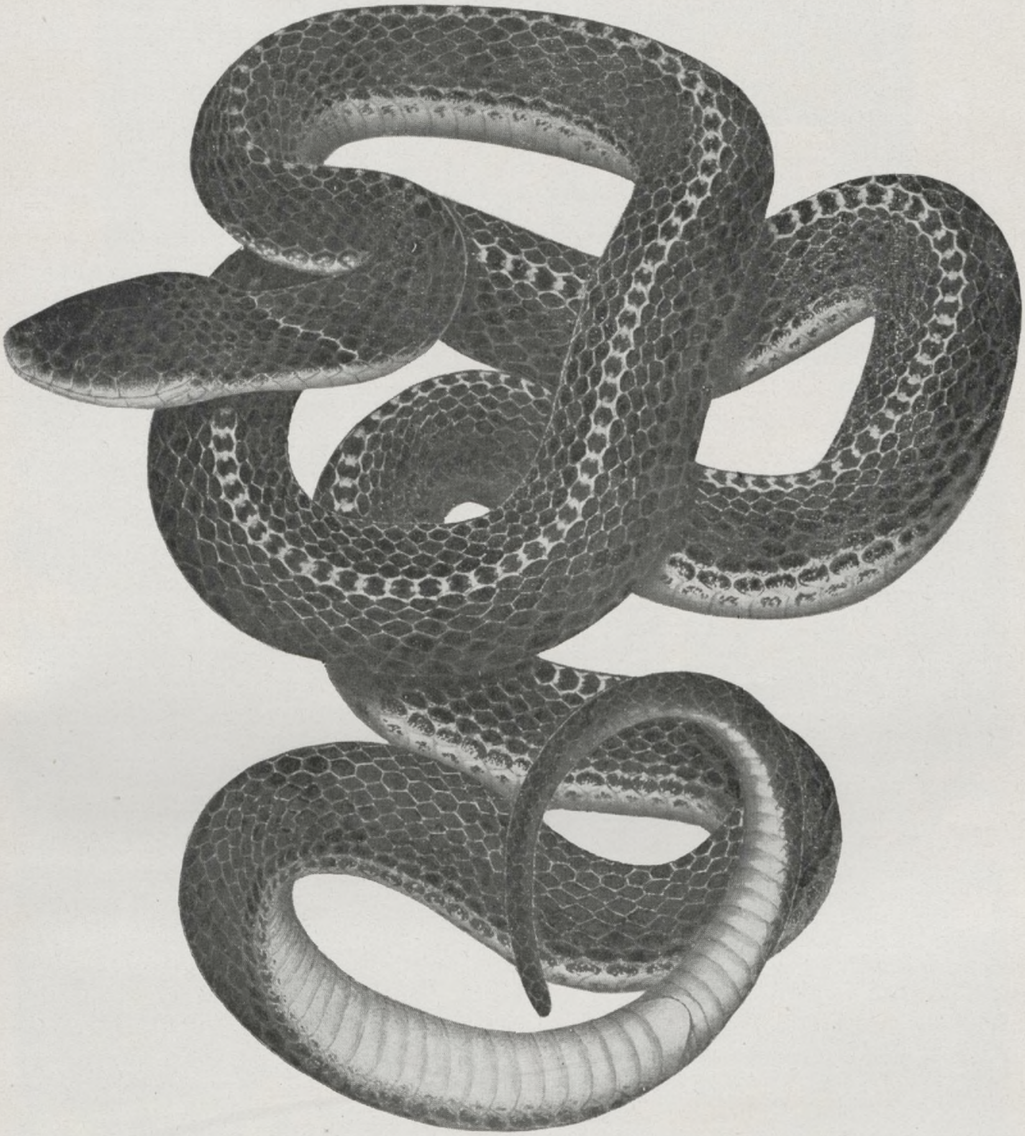
Damonia subtrijuga SCHLEG. & MÜLL. (Fig. 14).

Ein ♀ aus Cheribon legte am 26.X.-30 ein (vermutlich unbefruchtetes) Ei von 41.5 × 24.5 mm.

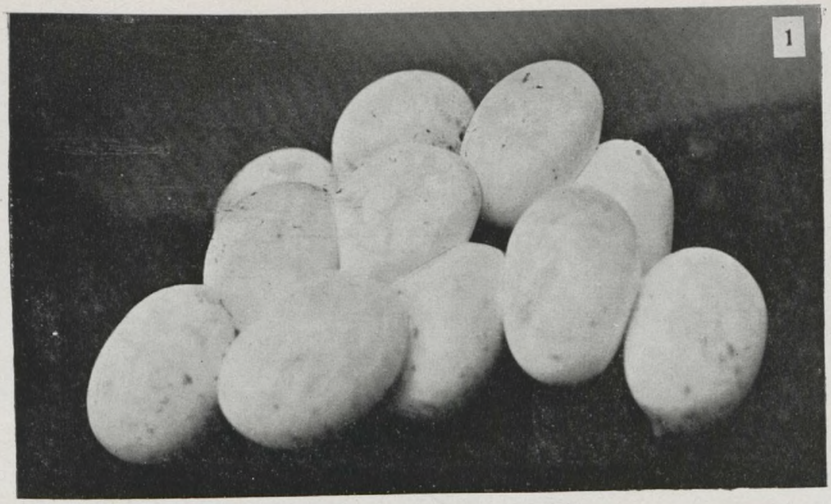
EMYDOSAURIA.

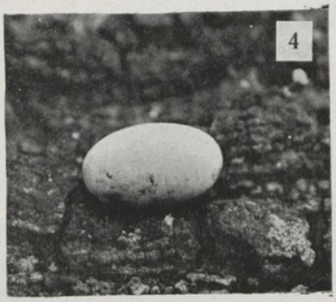
Crocodilus porosus SCHN. (Fig. 15, 16, 17, 18, 19).

In Ergänzung zur früheren Beschreibung in Treubia XI, werden hier die Bilder des am 26.XII.-27 bei Padaherang in West-Java gefundenen Nestes von *Crocodilus porosus* (Fig. 18) geboten. Fig. 19, zeigt den Weg, welchen das ♀ vom Nest zum Fluss platt tritt. Fig. 15 und 17 demonstrieren in natürlicher Grösse den ersten Schnitt des Eizahnes und den Beginn des Auskriechens.



Bungarus javanicus.





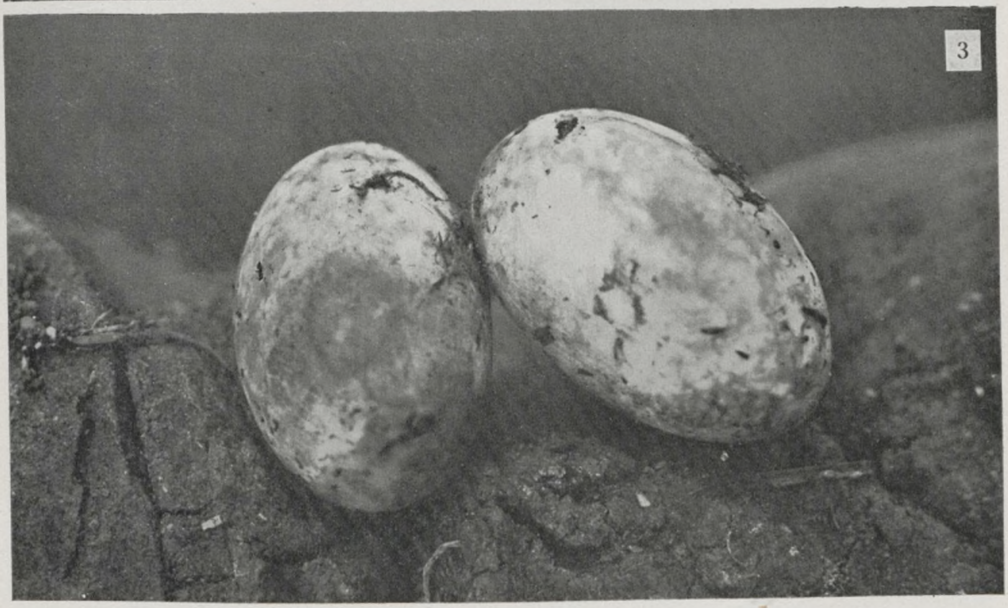


Fig. 1. *Tropidonotus piscator*; Fig. 2. *T. chrysargus*; Fig. 3. *Naja tripudians sputatrix*; Fig. 4. *Calamaria linnaei.*

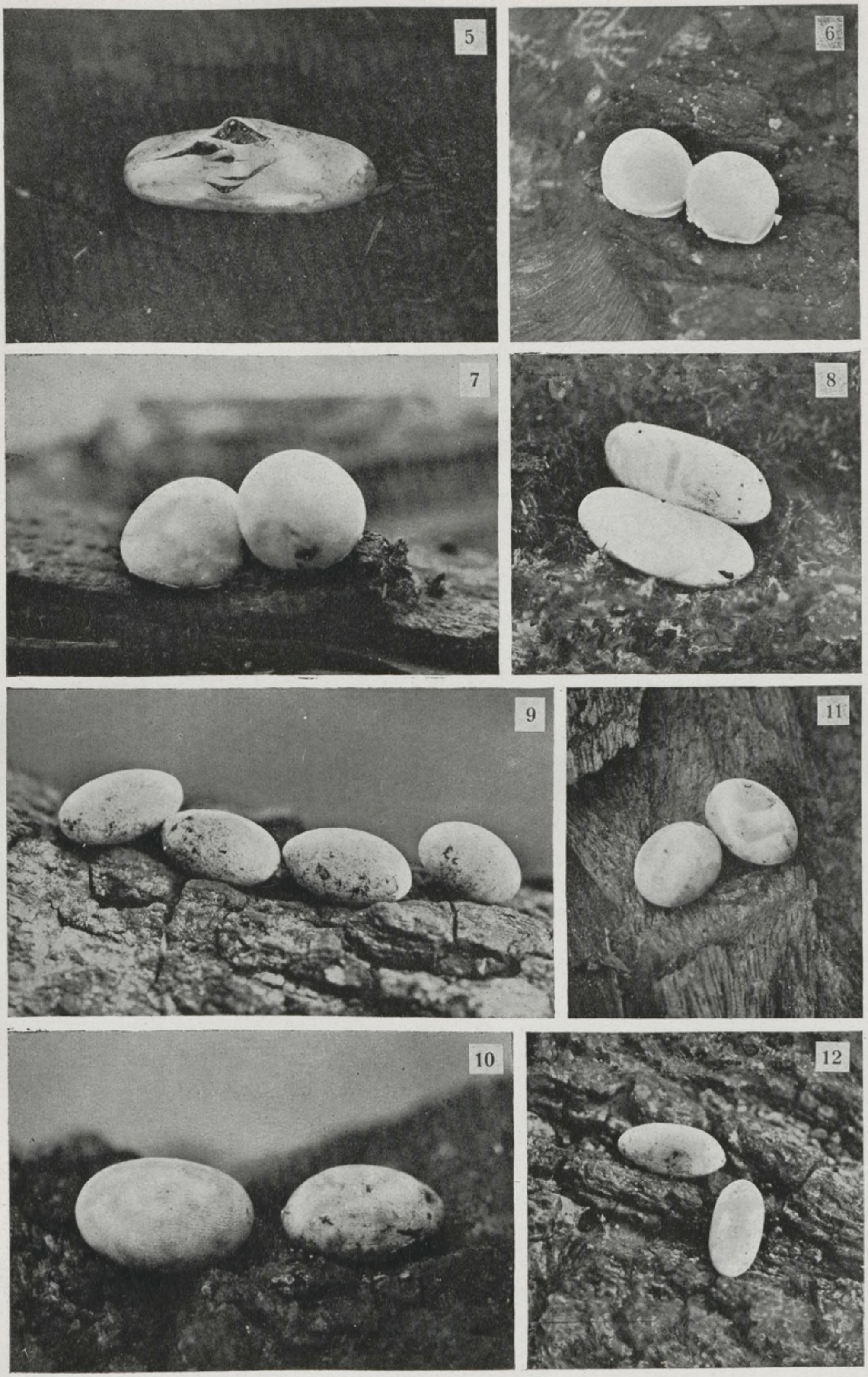
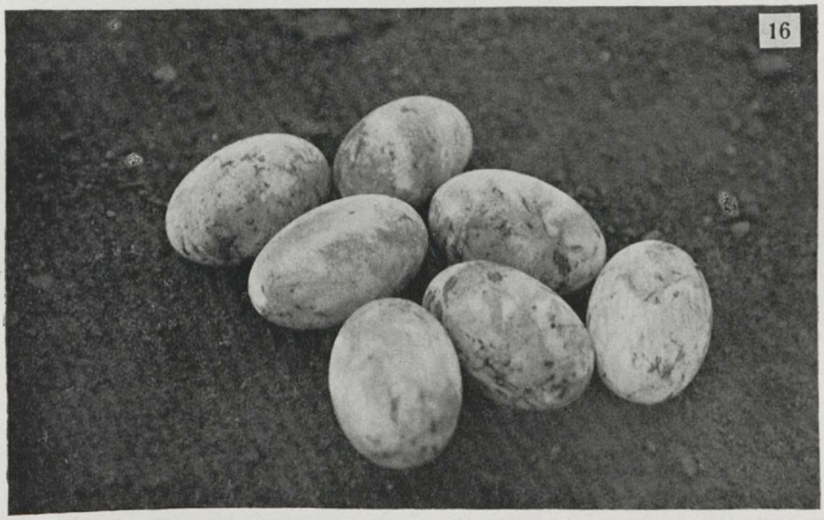
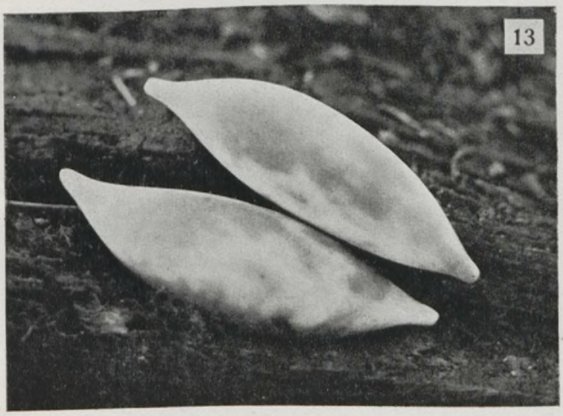


Fig. 5. *Dendrophis pictus*; Fig. 6. *Ptychozoon homalocephalum*; Fig. 7. *Gecko verticillatus*; Fig. 8—10. *Gonyocephalus chamaeleontinus*; Fig. 11. *Draco fimbriatus*; Fig. 12. *Calotes tympanistriga*.





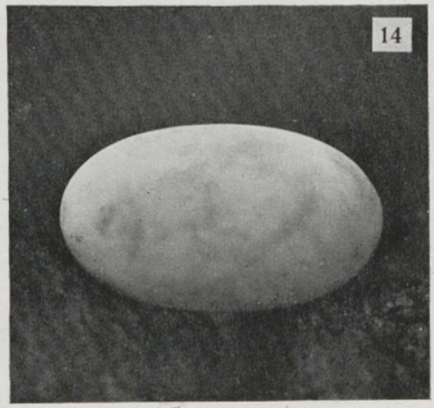


Fig. 13. *Calotes jubatus*; Fig. 14. *Damonia subtrijuga*; Fig. 15—16. *Crocodilus porosus*; 15. Der erste Schnitt des Eizahnes (nat. Gr.); 16. Eier, stark verkleinert.

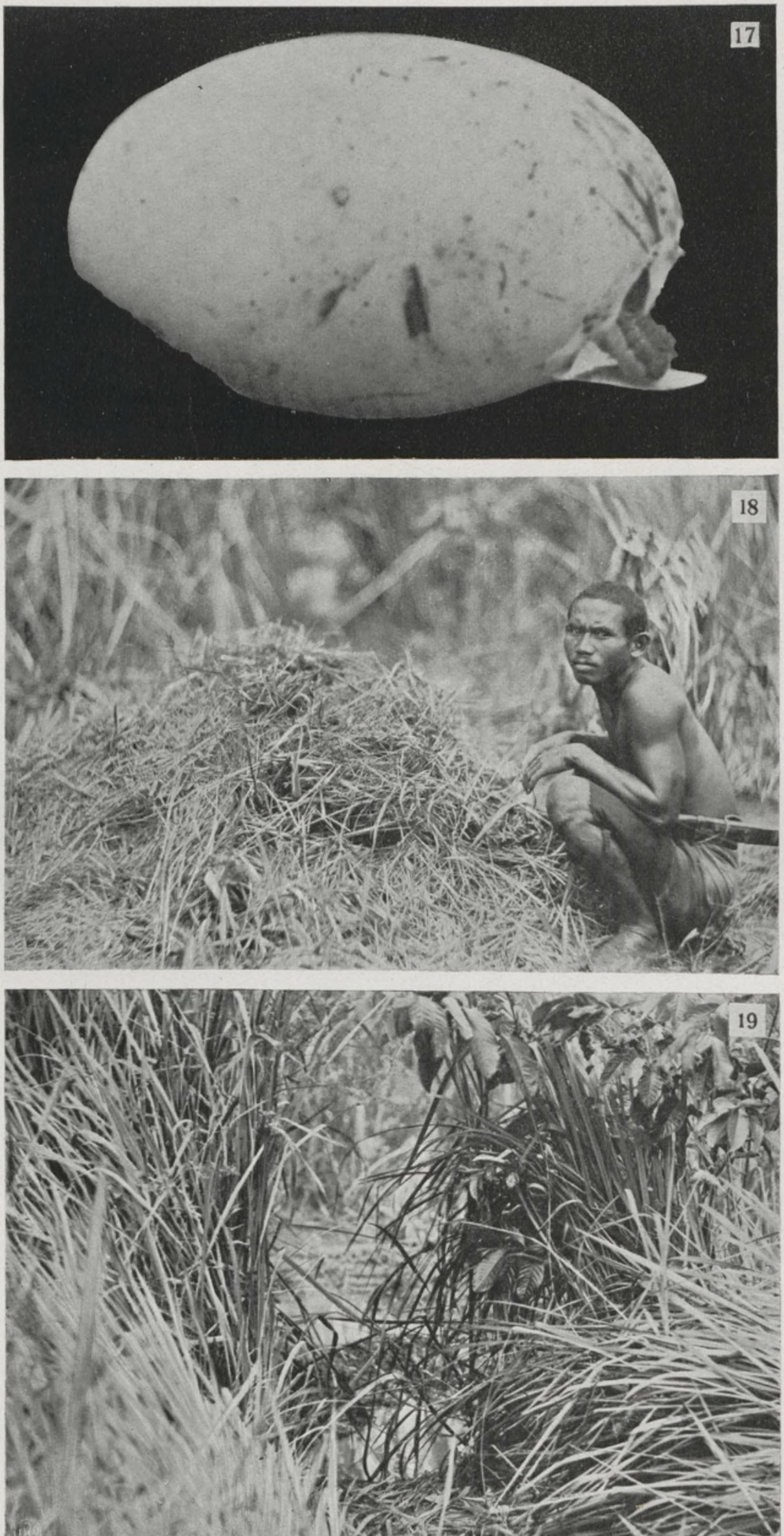


Fig. 17—19. *Crocodilus porosus;* 17. Ei (nat.Gr.) ; 18. Nest; 19. Weg vom Nest zum Fluss.

BEITRÄGE ZUR KENNTNIS DES TRIBUS DER HORIINI DER FAMILIE DER MELOIDAE (Col.).

1. Die Systematik der Horiini.

Von

Dr. J. G. BETREM.

(Malang, Java).

Diese Arbeit ist die erste einer Serie von drei. Die zweite Arbeit wird die Beschreibung der Larven einiger indischen Arten enthalten, die dritte biologische Beobachtungen über diese Horiini von Herrn Prof. Dr. W. ROEPKE.

Diese erste Arbeit behandelt die Systematik der Horiinen der ganzen Welt. Die malayischen Arten sind am ausführlichsten beschrieben, weil mir hiervon ein sehr umfangreiches Material zur Verfügung stand. Dass diese Arbeit ziemlich umfassend gestaltet werden könnte, verdanke ich der Freundlichkeit des Herrn K. G. BLAIR vom British Museum, des Herrn F. BORCHMANN vom Museum Hamburg, des Herrn H. BLÖTE vom Museum Leiden und des Herrn Prof. Dr. W. ROEPKE, Direktor des Entomologischen Laboratoriums der Landwirtschaftlichen Universität in Wageningen [1]). Die Herrn übergaben mir viel Material zur Bearbeitung. Herrn BLAIR bin ich ausserordentlich dankbar für die Vergleichung einiger Exemplare mit den Typen, die sich in dem British Museum befinden; besonders wertvoll waren für mich seine Angaben über die afrikanischen Arten. Weiter war Herr Prof. Dr. SCHRÖTER so freundlich mir die Typen von FABRICIUS der *Horia testacea* FABR. 1787, die im Museum der Universität Kiel aufbewahrt sind, zur Untersuchung zu überlassen. Herr Prof. Dr. ROEPKE, überliess mir die schönen Zeichnungen der *H. roepkei* und *H. maxillosa*.

Die älteste bekannte Beschreibung einer Horiine ist die von SCHRÖTER im Jahre 1776. Er beschreibt das Tier unter den Namen *Cantharis sanguinolenta* L. Die Art soll in Suriname gefunden sein. Weder aus seiner Beschreibung noch aus seiner Abbildung, ist zu ersehen welche Art gemeint ist. Aus seiner Abbildung geht hervor, dass er vermutlich ein ♀ des Subgenus *Horia* vor sich gehabt hat. In seiner Beschreibung sagt er, dass das dritte Beinpaar eine "überaus grosse Keule" hat, die auch auf seiner Abbildung deutlich sichtbar sein soll. Die Figur aber zeigt dieses Merkmal keineswegs. Möglicherweise hat er beide Geschlechter vor sich gehabt, das ♂ beschrieben und das ♀ abgebildet. Die Fundortsangabe ist sicherlich falsch, weil Vertreter der Gattung *Horia* nicht

[1]) Durch die Liebenswürdigkeit der Herrn Dr. K. DAMMERMAN und M. LIEFTINCK konnte ich nach Fertigstellung des Manuskripts auch noch die Horiini des Museums in Buitenzorg bearbeiten. Die Fundortsangaben konnten noch im Text eingetragen worden.

aus Suriname bekannt sind. Der Namen *sanguinolenta* ist nicht zu verwenden, da er sich auf eine Art von Linné bezieht, die jedenfalls nicht zu den Horiinen gehört.

Die typische Gattung des Tribus ist das Genus *Horia,* das Fabricius im Jahre 1787 (Mant. Insect. I. p. 164) beschrieb. Nur eine Art kannte er, *Horia testacea,* aus Tranquebar. Die Typen dieser Art befinden sich im Zoologischen Museum der Universität Kiel. Fabricius synonimisiert seine Art mit *Lymexylon testaceum,* von ihm beschrieben im Jahre 1781 (Spec. Ins. I, p. 256). Letztere ist jedoch eine ganz andere Art, wie die Type beweist, die sich in der Collection Banks im "British Museum" befindet. Herr Blair war so freundlich mir zu berichten, dass es sich um ein afrikanisches ♀ der Artengruppe handelt, die Kolbe *Synhoria* genannt hat. Hieraus geht hervor, dass *Horia testacea* Fabr. 1787 die Genotype des Genus *Horia* ist, dass aber der Namen *testacea* praeoccupiert ist durch die Fabricius'sche Beschreibung von 1781. Ich habe darum einen anderen Namen für die Type des Genus vorgeschlagen nämlich: *fabriciana.*

Später sind noch zwei andere Artengruppe unter besonderen Namen beschrieben worden: *Cissites* Latreille 1804 mit der type *C. maculata* (Swed. 1787) und *Synhoria* Kolbe 1897. Cros 1924 hat *H. cephalotes* Ol. 1795 zur Genotype der letzgenannten Artengruppe erwählt.

Im Jahre 1802 hat Latreille in seiner "Historie naturelle générale et particulière des Crustacés et des Insectes", Tl. III, p. 182, die Ansicht vertreten, dass *Horia maculata* zu einer anderen Gattung gehört wie *Horia testacea.* In Teil V (p. 243) 1803 gibt er der neuen Gattung den Namen *Tachys.*

Im Jahre 1804, in seinem Teil X, ändert er diesen Namen ohne einen Grund anzugeben in *Cissites,* welcher Name seitdem regelmässig gebraucht wurde. Unglücklicherweise hat Latreille die zwei Genera im Jahre 1807 in seinen "Genera Crustaceorum et Insectorum" Teil II, p. 211 verwechselt. Seit 1807 ist daher der Name *Horia* für *Cissites* und *Cissites* für *Horia* gebraucht worden, bis Gahan (A.M.N.H. (8)2, p. 199-292) den ursprünglichen Namen wiederum einführte.

Der Gattungsname *Tachys* Latr. ist nicht gültig, weil Latreille in dem Teil seiner Arbeit in dem dieser Name angewendet wird, den Gattungen französisierte lateinische Namen gibt. Weil *Tachys* nicht zu französisieren ist, benutzt er dieses Wort unverändert. Es ist also augenfällig, dass Latreille mit dem Namen *Tachys* ein französisches Wort beabsichtet hat, und dass also der Name nicht lateinisch und den Regeln der internationalen Nomenclatur zufolge nicht gültig ist.

Bestimmungstabelle für die Genera.

a. Episterna des Mesothorax einander vor dem Mesosternum nicht berührend oder sich nur auf einem Punkt berührend. Kopf hinter den Augen beim ♀ und ♂ stark verbreitert, trapezförmig, so breit oder breiter wie das Pronotum oder die Basis der Flügeldecken. Augen auf der Unterseite des

Kopfes einander nicht genähert, sondern weit geschieden. Kopf vorn abgestutzt. Mandibeln stark, jedoch niemals auffällig verlängert. Prosternum zu einer langen Spitze verlängert. Der Aussenrand der Procoxen sehr scharf, Procoxen dort fast blattförmig zusammen gedrückt. Flügeldecken immer schwarz gezeichnet; Aussenrand des ersten Fühlergliedes nicht fast kreisförmig gerundet. Amerikanische Arten .... **Cissites** LATR. 1804.

b. Berührungsstelle der Episterna des Mesothorax viel breiter, Kopf hinter den Augen nur wenig oder nicht verbreitert, nur bei *H. maxillosa* F. 1801 trapezförmig. Prosternum hinten ohne oder nur mit kurzer Spitze. Procoxen ohne messerscharfen Aussenrand, dieser mehr gerundet. Flügeldecken nur äusserst selten schwarz gefleckt. Arten der alten Welt. ...... **Horia** F. 1787.

Genus **Cissites** LATR. 1804.

BESTIMMUNGSTABELLE FÜR DIE ARTEN.

a. Ant. beim ♂ sehr lang, mindestens die hinteren Coxen erreichend. Kopf mit tiefem Längseinschnitt, jederseits von diesem ein grosser Buckel; Tarsen, besonders die Metatarsen, stark verlängert; Ecken des Pron. gerundet; Kopf auf der Oberseite glänzend, nicht dicht punktiert.
C. auriculata (CHAMP. 1892).

b. Ant. nur die Schulterbeule erreichend, kurz. Kopf ohne solchem Längseinschnitt und ohne Buckel, beim ♂ angedeutet. Tarsen nicht verlängert. Vorderecken des Pronotums sehr deutlich; Kopf oben grossenteils dicht p. matt .... **C. maculata** (SV. 1787).
   A. Zwischen der basalen und apikalen schwarzen Makeln der Flügeldecken keine Makeln .... **Varietas apicalis** PERTY 1840.
   B. Zwischen basalen und apicalen schwarzen Makeln der Flügeldecken verschiedene Makeln .... **Forma typica.**
   C. Nur eine oder zwei Makeln zwischen den apikalen und basalen Makeln der Flügeldecken .... **Varietas intermedia** BETR.

Die zwei Arten dieses Genus sind so scharf geschieden, dass eine ausführliche Beschreibung unterbleiben kann. *C. apicalis* PERTY ist unzweifelhaft nur eine Varietät der *C. maculata* SVED. Die Exemplare stimmen in der P. und Struktur ganz mit einander überein. Vielleicht ist die Varietät *apicalis* eine Unterart. Mehr Material muss hier die Entscheidung bringen.

C. auriculata (CHAMPION 1892).

M e x i c o. 1 ♂, Coll. STAUD., 1 ♀, Balzas, Guerrero; 2 ♀ Colima; 2 ♀, 2 ♂, Tehuacan, Coll. STAUD. und M.L.

G u a t e m a l a. 7 ♂♂, 1 ♀, M.L., Coll. STAUD.; 1 ♂, ohne Funort.

C. maculata (SVED. 1787).

B r a s i l i e n. 5 ♀, 7 ♂; 1 ♀, Esperito Santo; 1 ♂, Joinville; 2 ♀♀, 2 ♂♂, San Paulo; 2 ♂♂, 4 ♀♀, St. Catharina; 1 ♀, Theresopolis.

C o l u m b i e n. 1 ♀, Cauca; 1 ♂, Caidas, Cauca-Tal; 1 ♂, Coli.

V e n u z u e l a. 3 ♂♂, 1 ♀; 1 ♂, Caracas.

Ecuador: 1 ♀, 1 ♂; 1 ♀, Bucay.

Peru: 1 ♀; 1 ♂, Isquitos; 1 ♂, Chanchamayo. Alle Specimina aus dem M.L. und der Coll. STAUD.

Var. **apicalis** PERTY 1830.

Plesiotypen. 1 ♀, 1 ♂, Isquitos, Peru, M.L.

Var. **intermedia** nov. var.

Holotype. 1 ♂, Columbien, M.L.

Genus **Horia** F. 1787.

BESTIMMUNGSTABELLE DER SUBGENERA.

a ♂ mit verdickten, hinteren Femora (bei *H. nitida* weniger deutlich). Mandibeln bei beiden Geschlechtern nicht ausserordentlich vergrössert. Chitinbrücke auf der Unterseite des Kopfes, zwischen den Augen schmal, nur bei *H. nitida* etwas breiter. Tempora hinter den Augen von oben gesehen beim ♀ schmäler wie die Augen breit sind. Kopf immer deutlich schmäler wie die Basis der Flügeldecken und wie das Pronotum. Vorderecken des Pronotums deutlicher eckig, schwach gerundet.

Subgenus **Horia** F. 1787.

b ♂ ohne verdickte, hintere Femora. Kopf stark vergrössert und Mandibeln stark verlängert. Tarsen im allgemeinen bei beiden Geschlechtern schlanker. Kopf meistens so breit oder breiter wie das Pronotum und die Basis der Flügeldecken. Tempora von oben gesehen immer breiter wie die Augen breit sind; Chitinbrücke auf der Unterseite des Kopfes zwischen den Augen sehr breit; Pronotum vorn stark gerundet; Flügeldecken immer punktiert.

Subgenus **Synhoria** KOLBE 1897.

Subgenus **Horia** F. 1787.

BESTIMMUNGSTABELLE FÜR DIE ARTEN.

1a Flügeldecken nicht punktiert, nur gerunzelt, nicht behaart, stark glänzend, verdickte Femora des ♂ nur mit zwei Zähnen an der Spitze. Hintertarsen des ♀ nur sehr schwach comprimiert .... 2.

b Flügeldecken deutlich punktiert und gerunzelt, behaart, nicht stark glänzend, fast matt; verdickte Femora des ♂ mit vier Zähnen an der Spitze, Hintertarsen des ♀ stark comprimiert .... 3.

2a Hintertarsen auf der Aussenseite wenig punktiert, stark glänzend; der Kopf oberhalb der Antennen-Einlenkungen nicht erhöht und dort nicht grob punktiert. Pronotum hinten nicht schmäler wie in der Mitte. Chitinbrücke auf der Unterseite des Kopfes zwischen den Augen breit. Hintere Femora des ♂ nur schwach verdickt. Mittel-Afrika .... **H. nitida** GAHAN 1909.

b Hintertarsen auf der Aussenseite dicht punktiert, matt. Kopf über die Antennen-Einlenkungen erhöht und dort grob punktiert. Pronotum hinten schmäler wie in der Mitte. Chitinbrücke auf der Unterseite des Kopfes zwischen den Augen schmal. Hintere Femora des ♂ stark verdickt. Vorder-Indien; Africa .... **H. fabriciana** BETR. 1929.

3a Femora nur an der Basis bräunlich schwarz, übrigens wie auch die Tibien und Tarsen ganz schwarz. Die Coxen grossenteils schwarz. Apicale Innenspitze der Hintertibien in einen grossen Zahn ausgezogen, Aussenseite der Hintertarsen wenig punktiert. Punktierung auf den Scapulae sehr undeutlich. Apex der Flügeldecken undeutlich punktiert. Neu-Guinea.
H. blairi BETR.

b Apex der Femora breit schwarz, basaler Teil lackrot, Coxen lackrot ... 4.

4a Letztes Tarsenglied in der Mitte schmäler wie die Basis und der Apex; die Glieder zusammen etwas spindelförmig (Fig. 4A). Innenecke der Hintertibien in eine Spitze ausgezogen. Java, Sumatra, Borneo, Celebes, Philippinen, Vorder-Indien. Ceylon .... **H. debyi** (FAIRM. 1885).

b Letztes Tarsenglied in der Mitte so breit wie die Basis und der Apex; die Tarsenglieder zusammen nicht spindelförmig, sondern Aussen- und Innenseite fast parallel .... 5.

5a Höcker oberhalb der Antennen-Einlenkungen glatt. Pronotum weitläufig punktiert, besonders an den Seiten. Tibien III beim ♂ nicht in eine grosse Spitze ausgezogen. Java, Sumatra, Süd-Celebes, Bali, Saleyer.
H. roepkei BETR. 1929.

b Höcker oberhalb der Antennen-Einlenkungen deutlich punktiert. Pronotum gröber und viel dichter punktiert. Tibien III beim ♂ meistens in eine grosse Spitze ausgezogen. Vorderindien, Sikkim .... **H. gahani** BETR.

Horia nitida GAHAN 1909.

1909. Ruwenzori Exped., p. 207, F. 6, f. 13.
1924. CROS. Bull. Soc. Ent. Egypte 1924, p. 45.

GEOGRAPHISCHE VERBREITUNG: Mittel-Afrika. 2 ♂, Tangayika, M.L. (eines dieser Ex. hat Herr BLAIR mit der Type GAHANS verglichen); 1 ♀, Congo, M.L. (Fig. 1).

Horia fabriciana BETR. 1929.

!1787. FABRICIUS. Mant. Ins. I, p.164. *H. testacea*, nec F.1781.
1782. OLIVIER. Encycl. Method., Ins. VII, p. 101. *H. testacea* pro parte.
1795. OLIVIER. Ent. Hist. Nat. Ins.; Col. III, n. 53 bis, *H. testacea* p.p.
?1840. LAP. CASTELNAU. Hist. Nat. Ins., Col. II, p. 280. *H. senegalensis.*
?1890. AURIVILLIUS. Ent. Tidskr. II, p. 203. *H. africana.*
1908. GAHAN. A. M. N. H. (8)2, p. 202.
1909. CLAINPANAIN. Bull. Soc. Ent. Egypte 1909, p. 71. *Cissites senegalensis.*
1910. BUGNION. Bull. Soc. Ent. Egypte 1909, p. 198. *Cissites senegalensis.*
?1924. CROS. Bull. Soc. Roy. Ent. Egypte, p. 41, n. 4, ♀, ♂. *H. africana.*
1929. BETREM. Tijdschr. v. Ent. 72, Versl. p. XXVII.

Ich bin nicht überzeugt, dass die afrikanische Form mit glatten Flügeldecken zu derselben Art gehört wie die indische. Ich sah von der afrikanischen Form nur ein sehr kleines ♂ aus Senegal, M.L. Dieses Tier hat etwas anders gebildete Tarsen, wie die indischen Stücke. Ich habe darum den Namen *fabriciana* für die indischen Exemplaren reserviert; ob dieses richtig ist, müssen spätere Unter-

suchungen zeigen (Fig. 2). Über die Synonimierung dieser Art mit *H. testacea* OLIVIER habe ich mit Herrn BLAIR correspondiert. Das Resultat ist folgendes:

"Although of the latter OLIVIER writes, as you say: "Le mâle a les cuisses postérieures très renflées, et les jambes un peu arquées", yet the figures show straight tibiae not produced at the apex, sothat he apparently confused the two species figuring the one (*fabriciana*) and describing the other (*debyi*)".

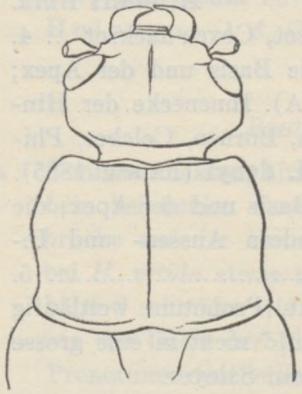


Fig. 1. — *Horia nitida* GAHAN 1909. Kopf und Pronotum.

Herr Dr. LESNE teilte mir bei meinen Besuch am M. Paris mit, dass die Sammlung von OLIVIER im Besitze gekommen ist von CHEVROLAT. Die Collection letzteres ist in mehreren Teilen verkauft worden. Vielleicht kann die Type OLIVIERS noch gefunden werden.

Cucujus clavipes F. 1787, den BORCHMANN als synoniem zu dieser Art angibt, ist nach freundlicher Mitteilung des Herrn BLAIR eine echte Cucujide.

GEOGRAPHISCHE VERBREITUNG: Vorder-Indien. 1 ♀, 1 ♂, Tranquebar, Typen von FABRICIUS, M. Univ. Kiel. Das ♂ habe ich gewählt als Hololectotype, das ♀ als Allolectotype; 1 ♂, Nepal, M. Hmbrg.; 1 ♀ Sikkim, M. L.; 3 ♀, 2 ♂, ohne Fundort, Coll. STAUD.; Sylhet, Karachi, Bengal, Madras, Coromandel, Bengalore, B.M., teste BLAIR. Ich sah aus dem B.M. 1 ♂ aus Sumatra, FRY Coll., 1905-100. Ich vermute, dass dieser letzte Fundort falsch ist.

Arika. 1 ♂, Senegal M. L.; Congo (AURIVILLIUS 1890); ? Egypt (CROS, 1924).

Horia blairi nov. spec.

♂. Gelbrot; schwarz sind: Coxae grossenteils, Femora, nur die Basis ist vorn und hinten breit dunkelbraun; weiter sind schwarz Tibien, Tarsi, die Basis der Klauen, Augen, Ant., Apex der Mandibeln und die Palpen.

Femora III sehr dick, am Ende mit vorn und hinten zwei Zähnen, der basale Zahn viel grösser wei der subapicale. Tibien III stark gebogen, Innenecke lang spitz ausgezogen nur mit einem Sporn. Tarsi III mit kurzen breiten Gliedern (Fig. 3); innen vorn sehr dicht, fein, steif beborstet, übrigens sind die Glieder fast glatt mit nur wenigen P.

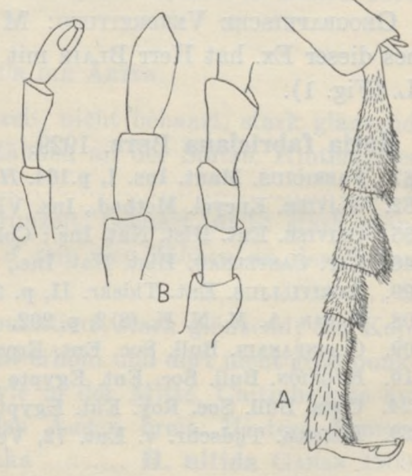


Fig. 2. — *Horia fabriciana* BETR. 1929. A. Tarsus III; B. Erste und letzte Glieder der Antennen; C. Maxillartaster.

Diese Art ist ausserordentlich nahe verwandt mit *H. roepkei* BETR.; unterscheidet sich durch:

1° Die P. des Kopfes zwischen den Augen und oberhalb des Clypeus ist weitläufiger und feiner, der glatte Raum in der Mitte ist viel breiter. 2° Die P. des Pron. ist viel weitläufiger und feiner, der glatte Raum in der Mitte ist breiter. 3° Die P. auf den Scapulae ist sehr weitläufig und untief, sodass die P. fast unmerkbar ist. Bei *H. roepkei* sind die P. deutlich wie P. ausgeprägt und stehen nicht so weitläufig. 4° die apikale Hälfte der Elytren sind mehr runzlig, die P. sind nicht sehr deutlich; bei *H. roepkei* sind die P. deutlicher ausgeprägt. 5° die Tarsi III sind auf den abgeplatteten Seiten viel weniger behaart. 6° Die Femora sind viel mehr geschwärzt. 7° Die abgeplattete Teil an der Basis der Mandibeln trägt oben viel weniger Haare und P.

Von *Horia mira* (BLACKBURN 1892) unterscheidet diese Art sich, nach schriftlicher Mitteilung von Herrn BLAIR, der so freundlich war die Type für mich zu untersuchen, durch Merkmale, die weiter unten angegeben werden. L. 22 mm.

Holotype: Neu-Guinea; ANDREWES-BEQUEST, 1922-221, B.M.

Die rotgelbe Farbe ist ursprünglich sicherlich schön lackrot gewesen. Die rote Farbe scheint in Alcohol auszuziehen, die Tiere werden dann gelblichrot. Eine Paratype, New Guinea 79-14 B.M. unterscheidet sich in folgenden Punkten von der Holotype. 1° die Tarsen III sind schmaler. 2° die Mandibeln sind fast ganz dunkel. 3° sie ist nur 20 mm lang. Übrigens stimmt sie ganz mit der Holotype überein, u.a. in allen Unterscheidungsmerkmalen mit *H. roepkei.*

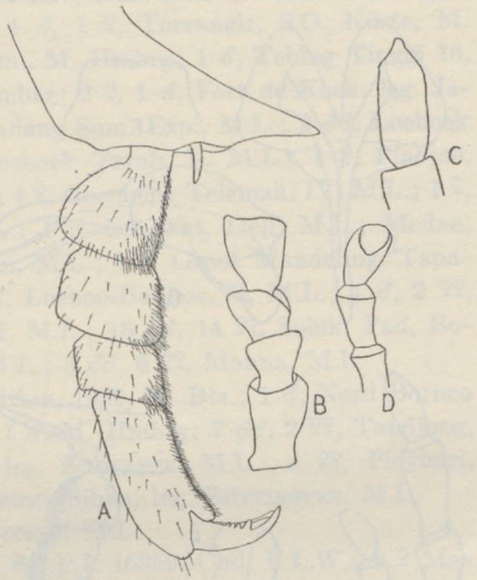


Fig. 3. — *Horia blairi* BETR. A. Tarsus III des ♂; B. Erste Antennenglieder; C. Letztes Antennenglied; D. Maxillartaster.

Horia debyi (FAIRM. 1885).

?1776. SCHRÖTER. Abh. Versch. Geg. Naturg. I, p. 364, T. 3. f. 6.
Cantharis sanguinolenta nec LINNAEUS 1767.
1792. OLIVIER. Encycl. Meth., Ins. VII, p. 101. *H. testacea* pro porte.
1795. OLIVIER. Ent. Hist. Nat. Ins., Col. III, n. 53 bis. *H. testacea* pro parte.
!1883. PRUDH. DE BORRE. Ann. Soc. Ent. Belgique XXVII, C.R. p. CXXXVI. *H. testacea.*
!1885. Ann. Soc. Ent. Belg. 29; C.R. p. 111, ♂♀. *Cissites debyi.*
?1890. AURIVILLIUS. Ent. Tidskr. XI, p. 203. *H. testacea.*
1924. CROS. Bull.Soc.Roy.Ent. Egypte, p. 40, n. 3. ♀♂.
1929. BETREM. Tijdschr. v. Ent. 72, Versl. p. XXVII.

♀ Gefärbt wie *H. roepkei* BETR.

Unterscheidet sich, hauptsächlich durch die Bildung der Tarsen (Fig. 4A); Glied 4 der Hintertarsen innen schwach ausgeschnitten, hierdurch bekommen die Tarsen eine ungefähr spindelartige Form; die Glieder 2 und 3 sind aussen an der Basis glatt, Glied 4 ist aussen nur mit sehr wenigen Punkten

besetzt. Pron. besonders in der Mitte und vorn feiner und etwas weitläufiger p. Frons über dem Clypeus ziemlich dicht p., darüber ligt ein breiter, glatter, bisweilen unterbrochener Querstreif, der bei *H. roepkei* fehlt. Frons übrigens feiner und nicht so dicht p., oberhalb der Einlenkungsstelle der Ant. wenig p. Innenorbita breiter glatt. Fühlerglieder besonders die ersten und die Glieder der Maxillarpalpen schlanker wie bei *H. roepkei* (Fig. 4D). Tibien meistens mit zwei Spornen. L. 26 mm; Fl. d. 21mm.

Plesiotype. Buitenzorg, leg W. C. v. HEURN, Coll. Ent. Lab. Wageningen.

♂ Gefärbt wie das ♂ der *H. roepkei*. Unterscheidet sich mit Ausnahme derselben Merkmale auch noch von *H. roepkei* durch die besonders bei den grösseren Ex. innen in eine grosse spitze ausgezogenen Tibien III. L. 29 mm. Fl.d. 32 mm.

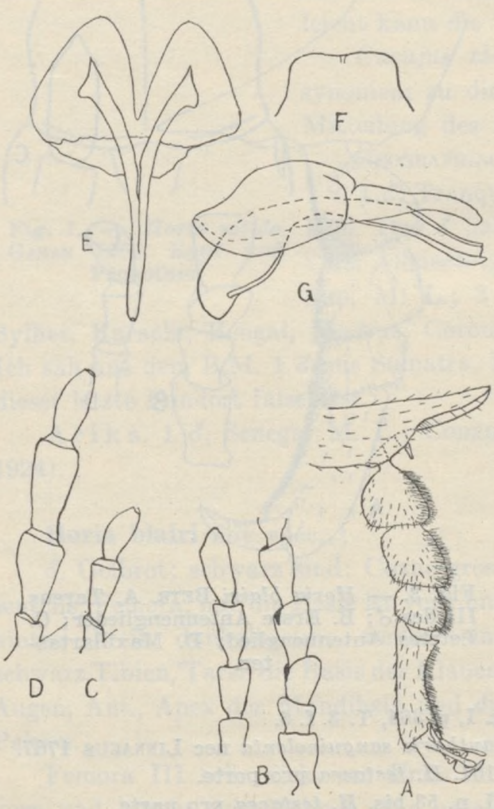


Fig. 4. — *Horia debyi* FAIRM. 1885. A. Tarsus III des ♂; B. Erste und letzte Antennenglieder; C. Labialpalp; D. Maxillarpalp; E. Hypopygium des ♂; F. Epipygium des ♂; G. Kopulationsapparat.

Plesiotype. Buitenzorg, leg. ROEPKE, Coll. Ent. Lab. Wageningen.

Die Holotype dieser Art sah ich im M. Paris. Es war ein ♂ mit der Zettel "Sumatra, leg. DEBY".

Das Exemplar das PRUDHOMME DE BORRE beschreibt aus dem M. in Brussel und das kam aus der Sammlung THOMSONS sah ich in diesem Museum. Es war ein Exemplar der *H. debyi*, das die Zetteln trug: "DEJEAN, ex Coll. THOMSON; n. 3794, *testacea*, Senegal. Die Fundorts angabe ist ungezweifelt falsch.

Im ganzen sind 245 Ex. dieser Art untersucht worden; das grosste Ex. war 30 mm lang, Fl.d. 26 mm; das kleinste 16 mm Fl.d. 13 mm. Diese Art ist im Durchschnitt grösser wie *H. roepkei* BETR.

GEOGRAPHISCHE VEBREITUNG: Java. ♀♀, 1 ♂, M. Hmbrg; 1 ♂, Gebirge bei Batavia, M. Hmbrg; 6 ♀♀, 3 ♂, Pradjekan, X, M. Hmbrg, Coll. STAUD.; 1 ♂, Salatiga, Coll. Ent. Lab. Wageningen; 1 ♂, Djati Roenggo, Coll. Ent. Lab. Wageningen; 1 ♂, Buitenzorg, Coll. Ent. Lab. Wageningen; 1 ♀, Semarang, III, M.L.; 1 ♀, 1 ♂, Preanger M.L.; 1 ♂, Batavia M.L.; 1 ♀, 1 ♂, Buitenzorg, M.L.; 1 ♂, Ardjoeno M.L.; 1 ♀, 1 ♂, Poentjak M.L.; 1 ♀, 1 ♂, leg REINWARDT, M.L.; 2 ♂, Pantjoer, Ost-Java, Coll. STAUD. 2 ♀♀, Idjen Plateau, II-III, 1921, M. Btz.; 1 ♀, ♂♂, Blawan, Idjen,

950 m, VI, 1924, leg. DAMMERMAN, M. Btz.; 2 ♂♂, 1 ♀, Karang Kidoel, Banjoemas, XII, 1921, leg. BENNER, M. Btz.; 1 ♀, Kendeng Gebirge 3000-4000′, I, leg. HEYNE, M. Btz.; 1 ♀, Priegen, M. Btz.; 1 ♀, Soepit Oerang, Goenoeng Smeroe, Coll. Versuchsstation Malang; 1 ♀, 1 ♂, Malang, IV, VII, Coll. Versuchsstation Malang; 1 ♀, Soember Asin, Goenoeng Kidoel, XII, 1926, Coll. Versuchsstation Malang; 1 ♂, 1 ♀, Buitenzorg, IV, leg. DAMMERMAN, M. Btz.

S u m a t r a. 2 ♂♂, 2 ♀♀, Bandar Baroe, Deli, 3000′, 1917, leg. DE BUSSY, M. Btz.; 1 ♂, Perdoeaan, Deli, VIII, 1929, leg. V.D. MEER MOHR, M. Btz.; 1 ♀, Deli, 1901, M. Btz.; 1 ♀, Pagar Alam, Lampongs, XI, 1913, M. Btz.; 1 ♀, Toba See, III, 1922, leg. DENIN M. Btz.; 8 ♂♂, 5 ♀, M. Hmbrg. M.L.; 2 ♂♂, Deli, M. Hmbrg; 3 ♀♀, Bindjei Estate, Deli; 2 ♀♀ Indrapura Estate, Deli, M. Hmbrg; 1 ♂, Soengei Lalah, Indragiri, M. Hbrg; 1 ♂, 1 ♀, Toerangir, S.O. Küste, M. Hmbrg.; 2 ♂♂, Padang Pandjang, W. Sum., M. Hmbrg; 1 ♂, Tebing Tinggi 16, I, 1885, M. Hmbrg; 1 ♀, Djambi, M. Hmbrg; 2 ♀, 1 ♂, Fort de Kock, leg. JACOBSON, M. Hmbrg., M.L.; 2 ♂♂, 3 ♀♀, Padang Sum. Exp., M.L.; 2 ♂♂, Loeboek Gadang, Sum. Exp. XII, M.L.; 1 ♂, Loeboek Tarab, V, M.L.; 1 ♀, Pladjoe, M.L.; 1 ♂, Boenga Ma, Palembang, M.L.; 1 ♀, Goenoeng Teleman, IV, M.L.; 1 ♀, Soerian, VIII, M.L.; 1 ♀, 1♂, Deli, M.L.; 1 ♂, Langkat, Deli, M.L.; Medan, Deli, M.L.; 1 ♂, 1 ♀, Padang Sidempoean, M.L.; 1 ♀, Groot Mandeling, Tapanoeli, M.L.; 1 ♂, Tapanoeli, M.L.; 3 ♂♂, Loeboe-Bankoe, V, M.L.; 1 ♂, 2 ♀♀, Benkoelen, M.L.; 1 ♂, Lubu-Lumpur, VI, M.L.; 18 ♂♂, 14 ♀♀, Solok, Pad. Bovenland., M.L.; 20 ♂♂, 18 ♀♀, Serdang, M.L.; 3 ♂♂, 6 ♀♀, Manna, M.L.

B o r n e o. 1 ♀, Nord Borneo Expedition, 1922, M. Btz.; 1 ♂, Nord Borneo Expedition, 1912, 704, C.N. 4, M. Btz.; 1 ♂, M. Hmbrg; 7 ♂♂, 2 ♀♀, Tandjong, S.O. Borneo; 1 ♂, Nord-Borneo; 1 ♀, leg. SCHWANER, M.L.; 3 ♀♀, Pleyhari, M.L.; 1 ♂, Sambas, M.L.; 3 ♂♂, 1 ♀, Poetoes-Sibau, leg. BÜTTIKOFER, M.L.

C e l e b e s. 3 ♂♂, Makasser, leg. PIEPERS, M.L.

P h i l i p p i n e n. 2 ♂♂, 2 ♀♀, Bu. of Sc. P.I. 16359, Coll. E.L.W.; 1 ♀ Manila, Coll. STAUD.

C e y l o n. 1 ♂, 1 ♀, M. Hmbrg; 1 ♀, 1 ♂, Coll. STAUD.

V o r d e r - I n d i e n. 2 ♀♀, 2 ♂♂, Madras, M. Hmbrg; 1 ♂, Surada Coll. 1 ♂, Madura Coll. STAUD.; Assam, Bombay, Bengalore, B.M., teste BLAIR.

I n d o - C h i n a, B.M., teste BLAIR. 1 ♀ "Oost-Indien" M. Hmbrg; 3 ♂♂, 2 ♀♀, ohne Fundort M.L.; 5 ♂♂, 5 ♀♀, idem Coll. STAUD.

Horia roepkei, BETREM 1929 (Taf. 7 Fig. 4).

?1776. SCHRÖTER. Abh. Versch. Geg. Naturg. I, p.364, F. 3, f. 6
Cantharis sanguinolenta nec LINNAEUS 1767.
?1890. AURIVILLIUS. Ent. Tidskr. XI, p. 203. *H. testacea.*
!1921. v. ZIJP. Treubia II, p. 94, *H. debyi.*
1924. CROS. Bull. Soc. Roy. Ent. Egypte, p. 36, n. 1, ♀♂. *H. testacea.*
1929. BETREM. Tijdschr. v. Ent. 72, Versl. p. XXVIII.

♀. Lackrot; schwarz sind: Apices der Femora, Tibien, Tarsen, Antennen, Labial- und Maxillarpalpen, Augen und Apices der Mandibeln; Basis der

Klauen braunrot. Behaarung fein und ziemlich lang, gelbrot, auf den schwarzen Teilen schwärzlich.

Basale Glieder der Antennen kurz (Fig. 5B). Apicales Glied schlank, mit deutlich abgesetzter Spitze (Fig. 5B). Tarsen compress, abgeplattete Aussenseite glänzend mit nur wenigen Haaren; Schmale Innenseite dicht und ziemlich lang behaart (Fig. 5A); die Glieder alle ungefähr gleich breit. Maxillarpalpen nicht sehr schlank (Fig. 5C). Kopf oben fein, nicht sehr weitläufig p., in der Mitte zwischen den Augen ein schmaler, glatter Längsstreif; die Haare sind dort nach rechts und links gerichtet; über den Einlenkungsstellen der Ant. ist der Kopf glatt oder fast glatt; verjüngter Teil des Kopfes auch glatt. Pron. weitläufig p., an den Seiten sehr weitläufig p., hinter der Mitte ein schmaler Längsstreif glatt; zwei seichte Eindrücke befinden sich rechts und links auf der Scheibe; bisweilen ist eine Mittellängslinie angedeutet. Scapulae weitläufig p., Elythren ziemlich dicht, deutlich, fast runzlich p.; Tibien III fast immer mit einem Sporn; L. 21 mm; Fl.d. 19 mm.

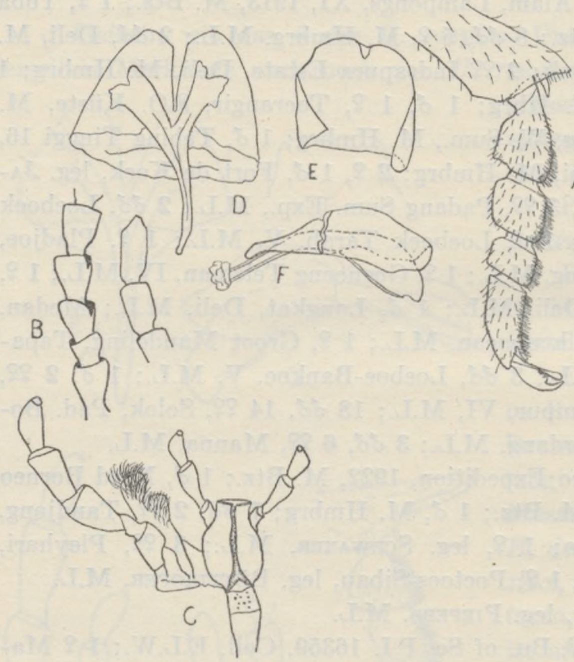


Fig. 5. — *Horia roepkei* BETR. 1929. A. Tarsus III des ♂; B. Erste und letzte Antennenglieder; C. Labium und linke Maxille; D. Hypopygium des ♂; E. Epipygium des ♂; F. Kopulationsopparat.

H o l o t y p e. Buitenzorg, leg. ROEPKE; Coll. Ent. Lab. Wageningen.

♂. Färbung und Struktur wie beim ♀.

Femora III, bei den kleinen Ex. ziemlich, bei den grossen Ex. sehr stark geschwollen; am Ende aussen jederseits mit einem grossen, schlanken und einem kleinen Dorn. Tibien III, stark gebogen. Apicale Innenecke nicht stark spitz ausgezogen, wenigstens viel weniger wie bei *H. debyi* FAIRM.; Tarsi III meistens kürzer und breiter wie beim ♀. L. 13 mm; Fl.d. 19 mm.

A l l o t y p e: Buitenzorg, leg. ROEPKE, Coll. Ent. Lab. Wageningen.

GEOGRAPHISCHE VERBREITUNG: J a v a: 23 ♂♂, 25 ♀♀, Buitenzorg Coll. Ent. Lab. Wageningen; grösste ♂ 29 mm, Fl.d. 23 mm; kleinste ♂ L. 16 mm, Fl.d. 13 mm; grösste ♀ L. 28 mm Fl.d. 22 mm; kleinste ♀ L. 15 mm, Fl.d. 12 mm, 4 ♂♂, 1 ♀, Java, M. Hmb.; 1 ♂ (L. 30 mm, Fl.d. 24 mm) Vulkan Boerangrang, Java, M. Hmb.; 1 ♀, 1 ♂, Tegal, M. Hmb.; 2 ♂♂, Java, leg. REINWARDT, M.L.;

2 ♂♂, 1 ♀, Java, Coll. Heylearts, M.L.; 3 ♂, 1 ♀, Garoet M.L.; 5 ♂♂, 1 ♀, Semarang, III, IV, VII, IX, XI, leg. Drescher, M.L.; 1 ♂, 2 ♀, Buitenzorg, M.L.; 1 ♂, 1 ♀, Tjilatjap, M.L. 1 ♀, Ambarawa, M.L.; 4 ♂♂, Java, Coll. Staud.; 1 ♂, Batavia Coll. Staud.; 4 ♂♂, Java B.M.; 1 ♂, Kendeng Gebirge, Coll. Staud.; 1 ♀, Kali Wining, Besoeki, II, 1927, Coll. Versuchsstation Malang; 1 ♀, Ngredjo, Goenoeng Kawi, VII, 1928, Coll. Versuchsstation Malang; 1 ♀, Karanggandoel, Banjoemas, XII, 1921, leg. K. Benner, M. Btz.

Bawean (Cros, 1924).

Süd-Celebes. 1 ♀, Samangga, XI, M. Hmbrg.

Bali. 1 ♀, 1 ♂, leg. Bleeker, M.L.

Saleyer. 1 ♂, 20, I, 1881, leg. Engelhard, M.L.

Sumatra. 1 ♂, Soekadam, Lampongs, leg. v. Hasselt, M.L.

"Ost Indien" 1 ♀, 1 ♂, M. Hmb.; 3 ex. ohne Fundort, Coll. Staud.

Insgesamt sind 88 Ex. dieser Art untersucht.

Horia gahani nov. spec.

♀. Färbung wie *H. roepkei* Betr. Interscheidet sich von dieser Art leicht durch die P.; Kopf dichter p., besonders oberhalb der Ant-Einlenkungsstellen; Pron. viel dichter p.; jederseits neben der Mitte mit einem grossen flachen, jedoch sehr deutlichen Eindruck. Mittellängsfurche hinter der Mitte nur sehr schwach angedeutet. Scapulae viel weitläufiger p. wie bei *H. roepkei;* auch die apicale Hälfte der Elythren viel weitläufiger p.; die P. sind jedoch nicht deutlich zu erkennen, weil die grobe Runzelung der Elythren sie etwas verdeckt. Die Bildung der Tarsi III, Antennen und Maxillarpalpen ähnlich der der *H. roepkei*; das letzte Fühlerglied hat jedoch eine andere Form. Tibien III mit zwei Spornen. L. 22 mm F.d. 17 mm.

Holotype: Gopaldhara, Rungbong Valley, Sikkim; leg. H. Stevens; B.M. 1922-307.

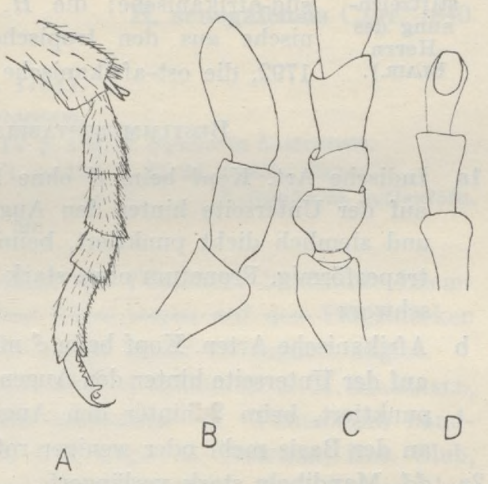


Fig. 6. — *Horia gahani* Betr. A. Tarsus III; B. Letzte Antennenglieder; C. Erste Antennenglieder; D. Maxillar-palp.

♂ Farbung wie *H. roepkei* Betr. Unterscheidet sich durch dieselben Merkmale von *H. roepkei* wie das ♀; Tibien III stark gebogen, innen in eine grosse Spitze ausgezogen. L. 27 mm. Fl.d. 22 mm.

Allotype: Gopaldhara, Rungbong Valley, Sikkim; leg. H. Stevens, B.M. 1922-307.

Horia mira (Blackburn 1892).

1892. Tr. R. Soc. S. Austral. XV, p.228, *Hoploxonites mira.*

Herr BLAIR war so freundlich mir folgendes zu schreiben über die Type der *H. mira:* "It differs" von *H. blairi* in certain particulars, the hind femora in *mira* being yellowish testaceous to near tip, this colour including the large tooth. The tibiae are straighter in the distal half, less produced at the apex; the tarsus with the basal point a little longer, etc." (Fig. 7, nach einer Bleistiftskizze des Herrn BLAIR).

Fig. 7. — *Horia mira* BLACKB. 1892. Tarsus III. (nach einer Bleistiftzeichnung des Herrn BLAIR.).

Holotype: Queensland, B.M. teste BLAIR.

Subgenus **Synhoria** KOLBE 1897.

1897 in: MÖBIUS. D. Oost. Afrika, Coleoptera, p. 256.

Die Arten dieser Gattung sind sehr schwer zu unterscheiden. Am leichtesten ist *H. maxillosa* F. 1801. zu erkennen. Zu Unrecht ist diese Art früher *H. cephalotes* OLIV. 1792 genannt. Diese letzte Art ist unzweifelhaft afrikanisch. Die drei afrikanischen Arten sind ausserordentlich schwierig, besonders die ♀♀, nur mit Hilfe von einigem Vergleichsmaterial sind sie sicher zu bestimmen. Besonders ist *H. testacea* F. 1781 schwierig von *H. senegalensis* CAST. 1840 zu trennen.

Die drei afrikanischen Arten scheinen jede für sich ein besonderes Verbreitungsgebiet zu haben. *H. testacea* F. 1781 ist die süd-afrikanische; die *H. senegalensis* CAST. 1840 west-afrikanische aus den tropischen Regenwäldern; *H. cephalotes* OLIV. 1792, die ost-afrikanische aus dem Savannen-Giebiet.

BESTIMMUNGSTABELLE FÜR DIE ARTEN.

1a Indische Art. Kopf beim ♂ ohne Zahn neben der Basis der Mandibeln, auf der Unterseite hinter den Augen ohne Zahn oder Buckel. Kopf fein und ziemlich dicht punktiert, beim ♀ hinter den Augen stark verbreitert trapezförmig. Pronotum ohne stark abgerundete Vorderecken. Femora ganz schwarz .... **H. maxillosa** F. 1801.

b Afrikanische Arten. Kopf beim ♂ mit Zahn neben der Basis der Mandibeln, auf der Unterseite hinter den Augen mit Zahn oder Buckel, oben sehr wenig punktiert, beim ♀ hinter den Augen stark verschmälert. Femora immer an der Basis mehr oder weniger rot .... 2.

2a ♂♂, Mandibeln stark verlängert .... 3.

b ♀♀, Mandibeln nicht besonders verlängert .... 5.

3a Clypeus über seine ganze Breite niedergedrückt, Seiten nicht verdickt, Endrand häutig. Labrum fast immer viel breiter wie lang. Vorderecken des Pronotums weniger gerundet. Eindrücke vor den Hinterecken des Pronotums weniger tief, Ant.-Glieder kürzer .... 4.

b Clypeus nur in der Mitte stark niedergedrückt, Seiten sehr stark verdickt, sodass die Seiten fast wie stumpfe Tuberkeln aussehen. Vorderrand haütig. Labrum meistens fast so breit wie lang. Vorderecken des Pronotums sehr stark gerundet; Punktierung des Pronotums feiner wie die des Kopfes.

Buckel der Tempora nach unten verlagert, dieser die Hinterecken des Kopfes nicht so stark genähert. Zahn auf den Genae mit mehr nach vorn gerichteter Spitze. Eindrücke vor den Hinterecken des Pronotums weniger tief. Antennenglieder kürzer .... **H. cephalotes** OLIV. 1792.

4a Pronotum gröber punktiert, fast so grob wie der Kopf hinter den Augen. Pron. jederseits mit Eindruck. Buckel auf den Tempora mehr lateral. Süd-Afrika .... **H. testacea** (FABR. 1781).

b Pronotum viel feiner punktiert, viel feiner wie der Kopf hinter den Augen. Buckel auf den Tempora mehr nach unten gerichtet.
H. senegalensis CAST. 1840.

5a Clypeus in seiner ganzen Breite niedergedrückt. Eindrücke auf den Hinterecken des Pronotums etwas schwächer .... 6.

b Clypeus nur in der Mitte stark eingedrückt, Ecken verdickt und wenig niedergedrückt. Eindrücke auf den Hinterecken des Pronotums stärker.
H. cephalotes OLIV. 1792.

6a Punktierung des Pronotums gröber, fast wie die Punktierung des Kopfes. Vorderrand des Clypeus in der Mitte schwach aufgerichtet.
H. testacea (F. 1781).

b Punktierung des Pronotums immer viel feiner wie die des Kopfes. Vorderrand des Clypeus flach, nicht in der Mitte aufgerichtet.
H. senegalensis CAST. 1840.

Horia (Synhoria) testacea (FABR. 1781).

1781. Spec. Ins. I, p. 256, ♀. *Lymexylon testaceum.*
1888. PÉRINGUEY. Trans. S. Afr. Phil. Soc. IV p. 134. ♂. *Synhoria hottentota.*
1909. PÉRINGUEY. Trans. R. Soc. S. Afr. I, 1, p. 175, ♀, T. 22, f. 2,2a, 2b,
♂. *Synhoria hottentota.*
1929. CROS. Bull. Soc. Roy. Ent. Egypte, p. 50.

Herr BLAIR war so freundlich mir einige von PÉRINGUEY bestimmte Exemplare zur Untersuchung zu schicken. Diese Tiere waren auf den Flügeldecken nicht schwarz gefleckt wie PÉRINGUEY für einige seiner Exemplare angibt.

GEOGRAPHISCHE VERBREITUNG: Süd-Afrika. 1 ♂, Coll. G. A. K. MARSHALL, B. M. 1926-166, mit einem Zettel *"Horia hottentota"* in "PÉRINGUEYS handwriting". Dieses ♂ ist 37 mm lang. 1 ♀, 1 ♂, Cape, E. NEWMAN, Ent. Club, 44-12, B.M. Das ♂ ist nur 22 mm lang; 1 ♀ Queenstown, Cape Colony, leg. E. T. WELLS, 1902-19. Dieses ♀ ist von Herr BLAIR verglichen worden mit der Type von FABRICIUS, die sich in der Sammlung BANKS in dem B.M. befindet; 1 ♀, Lijdenburg District, 1896, B.M. Natal, Damaraland, Ovampoland (PERINGUEY, 1888, 1889).

Horia (Synhoria) cephalotes OLIV. 1792.

1792. Encycl. Method. VII p. 102, ♂.
1795. OLIVIER. Ent. ou Hist. Nat. Ins. III, n. 53 bis, p. 5. T. 1. f. 3, ♂.
1873. GERSTAECKER. V. D. DECKENS. Reise Mosambique, Gliedertiere II, 2, p. 205,
♀ teste KOLBE 1897.

1897. KOLBE. MÖBIUS: Deutsch Ost Africa, Coleoptera, p. 256, ♂. *Synh. fisheri.*
?1894. FAIRMAIRE. Ann. Soc. Ent. Belg. 38, p. 329, ♀. *H. crouzeti.*
?1909. PERINGUEY. Tr. Roy. Soc. S. Afric. I, 1, p. 175, ♀. *H. rhodesiana.*
1924. CROS. Bull. Soc. Ent. d'Egypte, p. 44, 53, 54.

Ich betrachte diese Art als die echte *H. cephalotes* OLIV. 1792 weil ich von dieser Art einige Exemplare sah, welche mit der Beschreibung und der Figur von OLIVIER ganz übereinstimmen, besonders was die Kopfform und das Pronotum angeht. Eines dieser Exemplare, ein ♂ aus Uganda, 1919-298, B.M. habe ich zur Neotype erwählt. Herr LESNE war so freundlich mir mit zu teilen, dass die Type der *H. crouzeti* sich vermutlich in Rennes befindet.

GEOGRAPHISCHE VERBREITUNG: Kenya Colony. Kabete, X, 1921-50. B.M.

Uganda. 3 ♂, 1919, 298, B.M.; 1 ♀, Machakos, B.M.

Tangayika Territory. Früheres Deutsch-Oost-Afrika. 2 ♂, Coll. STAUD.; 5 ♂, 2 ♀, Ussanga; 1 ♂, Iringa; 1 ♂, Manow; 1 ♀, Moschi; 1 ♀, Kigonsera, M.L. und Coll. STAUD.; 1 ♂, 1 ♀, Tukuyu, 5084 ft. VII, 1925-159, B.M. Victoria-Nyanza (KOLBE, 1897).

Rhodesia. 1 ♂, N.W. Rhod., B.M.; Umtali S. Rhod. (PERING. 1909).

Nyassaland. 1 ♀, 1 ♂, Mlanje, V, leg. NEAVE, 1913-140. B.M.

Sansibar (KOLBE, 1897).

? Abessynien (FAIRMAIRE, 1894).

Horia (Synhoria) senegalensis LAP. DE CAST. 1840 (Taf. 7 Fig. 1).

1840. Hist. Nat. Ins. Col. II, p.280.
!1883. PRUD. DE BORRE. Ann. Soc. Ent. Belg. 27, p.CXXXVI.
!1887. FAIRMAIRE. Notes Leiden Mus. IX, p. 193, ♂, *H. macrognatha.*
!1888. FAIRMAIRE. Notes Leiden Mus. X. p.269, ♂, ♀. *H. cephalogona.*
1897. KOLBE. MÖBIUS: D. Ost. Afrika, Coleoptera, p. 256, ♀. *S. cephalotes.*
?1913. PIC. Coleopt. III, Voy. ALLUAUD et JEANNEL 1912—1913. *S. fisheri var. diversiceps.*
1924. CROS. Bull. Soc. Roy. Ent. d'Egypte, p. 39, 50 u. f.

Es ist sehr wahrscheinlich, dass obenstehende Art die *senegalensis* von LAPORTE DE CASTELNAU ist, weil diese Art die einzige ist, welche ausser *Horia africana* in diesen Gegenden vorkommt. DE BORRE hat in 1883 klargestellt, dass CASTELNAU zwei ♀♀ beschreibt, die nicht zueinander gehören. Ich erwähle nun diese Art zur Lectotype.

GEOGRAPHISCHE VERBREITUNG: Uganda. Kibwezi, 3000 ft. 1888, 1910-423, B.M.; Namirembe hill, Kampala, 1909-180, B.M.; 1 ♂, Entellt, 20, VIII, 1912-401, B.M.; 1 ♀ Nyansa See, M.L.

Tangayika Territory. Früheres Deutsch Ost Afrika, 1 ♂, 1 ♀, Ukerewe; 2 ♂, 2 ♀, Coll. STAUD., M.L.

Mosambique. 1 ♂, Sikumoa, Delagoabay, M.L.

Congo. 1 ♂, Leopoldville, M.L.; 1 ♂, Congo, leg. HUBRECHT, Type der *H. cephalogona* FAIRMAIRE; Landana, leg. PETIT, n. 3791, Expl. von PRUDHOMME DE BORRE im Jahre 1883 beschrieben, M. Brussel.

Sierra Leone. 1 ♂, 42-31; B.M.

Liberia-occidentale. 1 ♂, Type der *H. macrognatha* FAIRMAIRE M.L., Cap Palmas (KOLBE 1897).

Gold-Küste. 1 ♂, Bibianaha, X-XII, 1911-291; von DE BORRE bestimmt als *senegalensis* CAST., B.M.; 1 ♂, Goldküste, leg. RITSEMA BOS, Paralectotype der *H. macrognatha* FAIRM., M.L.; 1 ♀, Junk-River, leg. STAMPLI, Allolectotype der *H. macrognatha*, M.L.

Guinea. 1 ♀, Ex. Coll. MURRAY, FRY Coll. 1905-100. B.M. Dieses Exemplar ist von LAPORTE DE CASTELNAU als *senegalensis* bestimmt.

Angola. 1 ♂, M.L.

Süd-Afrika. 1 ♂, Port St. John, Pondoland, Oct. 1923-547, B.M.

Natal. Durban, XI, XII, 1902-230, B.M.; 1 ♂, Senaar. 99-238, B.M.

Horia (Synhoria) maxillosa FABR. 1801 (Taf. 7 Fig. 3).

1801. Syst. El. II, p. 86, ♂.
1885. FAIRMAIRE. Ann. Soc. Ent. Belg. 29. C.R. p. CXI, ♀. *H. anguliceps.*
1920. SCHROO, Trop. Natuur IX, p. 37, f. 8, ♂. *H. cephalotes.*
1921. ZIJP. Treubia II, p. 95, f. 2, ♂. *H. maxillosa.*
1924. CROS. Bull. Soc. Roy. Ent. d'Egypte, p. 57.

GEOGRAPHISCHE VERBREITUNG: Hinter-Indien. Burma (CROS, 1924).

Siam. (CROS, 1924).

Malakka. 1 ♂, Penang, Coll. STAUD.

Sumatra. 1 ♂, Tandjong-Morawa, Serdang, M.L.; 1 ♂, Fort de Kock, 920 M., Coll. Ent. Lab. Wag.; 2 ♀, Solok, Pad. Bovenlanden, M.L.; 1 ♀, Padang, Pandjang, 770 m., XII, M.L.; 1 ♀, Medan, I, Coll. Ent. Lab. Wag.; 3 ♂, Palembang, M. Hmb.; 1 ♂, Indrapoera Estate, IX-XII, M. Hmb.; 1 ♂, Bindjei-Estate, M. Hmb.; 1 ♂, West-Küste, B.S., 1915, M. Btz.

Borneo. 2 ♀, 5 ♂, Tandjong, S.O. Borneo, M. Hmb.

Java. 6 ♂, Salatiga, X, XI, Leg. ROEPKE, Coll. Ent. Lab. Wag.; 4 ♀, 3 ♂, Buitenzorg, M. Hmb. und Coll. Ent. Lab. Wag.; 1 ♂, Garoet, M.L.; 2 ♂, Preanger, M. Hmb.; 1 ♂, Tjipeu-eut, Soekaboemi, M. Btz.

Halmaheira. 1 ♂, 1 ♀, M.L.

Philippinen. 1 ♀, 2 ♂, Coll. Ent. Ent. Lab. Wag.; 1 ♂, Luzon, M. Hmb.; 1 ♀, Manila, M. Hmb.

Formosa. 1 ♂, 2 ♀, Fuhosho, VIII, M. Hmb.; 1 ♀, 1 ♂, Hoozan, M. Hbg.

China. 1 ♀, Shanghai, M.L.; 1 ♂, Kiukiang, M. Hmb.; 1 ♂, Kiangsi, M. Hmb.

Abkürzungen:

Ant. = Antennen; B.M. British Museum; Coll. = Collection; M. = Museum; M.Btz. = Museum in Buitenzorg; M.Hmb. = Museum in Hamburg; M. L. = Museum in Leiden; p. punktiert; P. = Punkte; Pron. = Pronotum; STAUD. = STAUDINGER.

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3*. BLACKBURN, Trans. R. Soc. S. Austral. XV, p. 228, 1892.
4. BORCHMANN, F. Meloidae, Cephaloidae; Coleopterorum Catalogus, Junk und Schenkling, Pars 69, 1917.
5. BORRE, PREUDHOMME DE. Note sur *l'Horia sénégalensis* CAST.; Ann. Soc. Ent. Belg. 27, C.R. p. CXXXVI, 1883.
6. BUGNION, Prof. Dr. E., Le *Cissites testaceus* F. des Indes et de Ceylon; Metamorphoses et Appareil génital; Bull. Soc. Ent. Egypte, 1909, 4. Lief. 1910.
7. CASTELNAU, F. LAPORTE DE. Hist. Nat. des Animaux Articulés, Coleoptères I, 1840.
8*. CLAINPANAIN. Bull. Soc. Ent. Egypte p. 81. 1909.
9. CROS, Dr. AUG. Révision des Espèces africaines et orientales des Genres *Horia* FABR. et *Cissites* LATR., avec Description de Larves inédites; Bull. Soc. Roy. Ent. d'Egypte, p. 24-80, 1924.
10. FABRICIUS, J. C. Species Insectorum 1781.
11. —— Mantissa Insectorum I, 1787.
12. —— Systema Eleuterorum I, 1801.
13. FAIRMAIRE, L. Malacoderines. Lymexylonides et Heteromères nouveaux, recueillies par M. DEBY à Sumatra et à Borneo; Ann. Soc. Ent. Belgique, 29, C.R. p. CV, 1885.
14. —— Description de cinq Espèces nouvelles de la Famille des Cantharides; Notes Leyden Museum IX, p. 193, 1887.
15. —— Coleoptères nouveaux de l'Afrique du Musée de Leyden; Notes Leiden Mus. X, n. 25, p. 269, 1888.
16. —— Coleoptères de l'Afrique intertropicale et de l'Australie; Ann. Soc. Ent. Belgique 38, p. 314; 1894.
17. GAHAN, C. J. Notes on the coleopterous Genera *Horia* FAB. and *Cissites* LATR., and a List of the described Species; A.M.N.H. (8)2, p. 199-204, 1908.
18*. —— Horiini; Ruwensori Expedition, 1909.
19. GERSTAECKER, A. Die Gliedertier-Fauna des Sansibar-Gebietes. Deckens Reise Ost-Africa 1873.
20. KOLBE, H. J. Coleoptera in Deutsch-Ost-Afrika, herausgeg. v. Dr. K. MÖBIUS, Bnd. IV, 1898.
21*. LACORDAIRE. Genera des Coléoptères II, p. 664.
22. LATREILLE, P. A. Hist. Nat. Générale et Particulière des Crustacés et des Insectes III, 1802; V, 1803; X, 1804.
23. LINNÉ, C. Systema naturae T. 1, Pars II, Ed. XII, Holmiae 1767 (p. 647. *Cantharis sanguinolenta)*.

Fig. — Kopf der *Horia senegalensis* CAST., ♂.

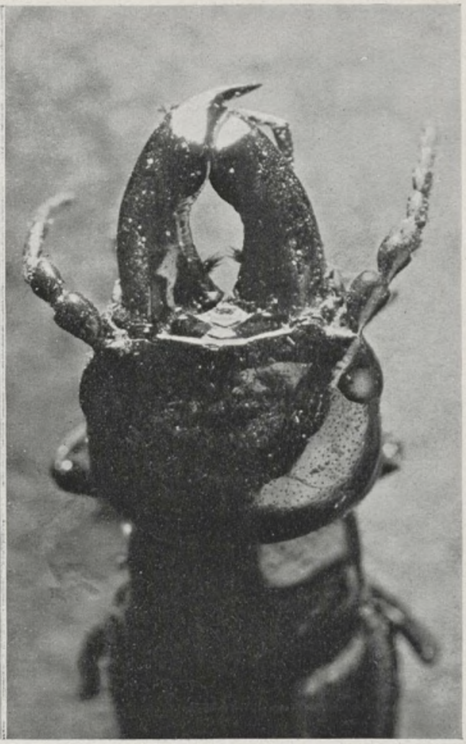

Fig. 2. — Kopf der *Horia cephalotes* OLIV., ♂.

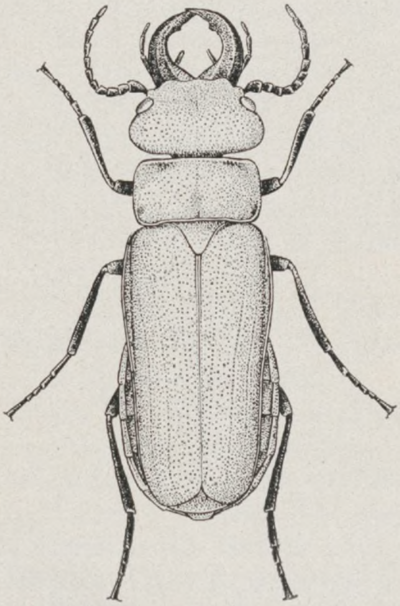

Fig. 3. — *Horia maxillosa* F., ♂.

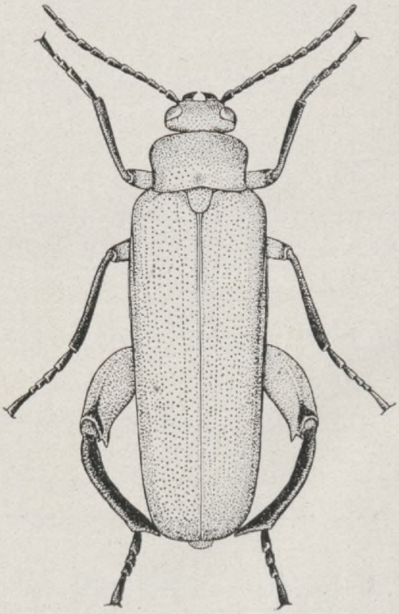

Fig. 4. — *Horia roepkei* BETREM., ♂.

24. Olivier. Encyclopodie Methodique VII, Histoire naturelle des Insectes IV, p. 101, 1792.
25. Olivier. Entomologie, ou Histoire Naturelle des Insectes ;Coléoptères, III, 1795.
26*. Peringuey, Dr. L. Trans. Afric. Phil. Soc. IV, 1888.
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30. Schroo, H. Houtbijen; II *Horia cephalotes* Oliv., een parasiet der houtbijen; Tropische Natuur IX, p. 37, Weltevreden, 1920.
31. Zijp, C. v. Ueber das Vorhandensein von Cantharidin in *Horia debyi* und *Cissites maxillosa*; Treubia II, p. 93-96, Buitenzorg, 1921.

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*) Die mit einem Sternchen versehenen Publikationen standen mir nicht zur Verfügung.

ON PREHISTORIC SHELLS FROM SAMPOENG CAVE (CENTRAL JAVA).

By

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The remains of molluscs excavated from the Sampoeng Cave near Ponorogo are partly of marine, partly of non marine origin.

Several samples from the layers B, C and D were entrusted to me for identification and fortunately could be named without much trouble or hesitation owing to their fairly good state of preservation.

	B	C	D
LAND SHELLS.			
Hemiplecta javanica (FÉR.)	+	+	+
Plectotropis rotatoria (V.D. BUSCH)			+
Amphidromus filozonatus (MOUSS.)	+	+	
Cyclophorus perdix (BROD. & SOW.)	+	+	
FRESHWATER SHELLS.			
Pila conica (GRAY)	+	+	
Melania testudinaria V.D. BUSCH	+	+	+
— *tuberculata* (MÜLL.)		+	
Contradens contradens (LEA)	+	+	
Pseudodon zollingeri (MOUSS.)	+	+	
Rectidens sumatrensis (DKR.)	+	+	+
Elongaria orientalis (LEA)	+	+	+
BRACKWATER SHELLS.			
Cyrena spec. (fragments)	+	+	
MARINE SHELLS.			
Haliotis spec. (fragment)	+		
Nerita chameleon L.	+		
Natica mamilla L.	+		
Cypraea arabica L. (fragment)		+	
Nassa spec. (apertures only)	+		
Marginella quinqueplicata LAM.	+		
Venus spec.	+		

The marine shells, collected at a far off coast about which only vague rumours penetrated inland, evidently appealed especially to the imagination of the primitive inhabitants and were considered as objects of great value, being used as gems for necklace and other ornaments. The archaeologist, Dr. P. V. VAN STEIN CALLENFELS, under whose supervision the excavation of the grotto took place, has reported upon these shells himself (Homm. Serv. Arch. Ind. Néerl. 1er Congr. Préhist. Hanoi, 1932, p. 23-24).

In the preliminary paper on the geological research and on some of the prehistoric remains by VAN ES (Proc. Fourth Pacific Science Congress, 1929, Vol. III, 1930, p. 329) mention is made (p. 336) of the occurrence of *Nerita, Natica, Oliva, Meretrix* and *Trochus*, the three latter genera, however, are not represented in the material at my disposal. The same author records freshwater species of *Unio, Melania* and *Paludina* and of these three the *Paludina* did not reach me. In photo no. 6 accompanying his paper figures of *Natica mamilla* (right upper corner), of *Venus* spec. (to the left of former), of *Contradens contradens* (below *Venus*) and of a *Trochus* ? and a *Melania testudinaria* (below najad valve) are reproduced.

The second group, the non marine mollusca, or more precisely their soft bodies, have apparently been used as food. This has already been remarked by VAN ES (l.c. p. 336) and the large number of shells lying scattered between the great quantity of kitchen middens of vertebrate origin (mammals, birds and fishes) strongly pleads in favour of that supposition. Moreover, it is a common habit among primitive people to feed on snails and mussels from the vicinity. Nowadays throughout the whole Archipelago and even in many parts of Java the actual native inhabitants still use shellfish for their diet. Therefore we may assume with reasonable certainty that the early cave dwellers did so to a much greater extent. Finally the way in which the shells are damaged proves that they must have been opened by force for the purpose of extracting the mollusc's body. From the majority of the Gastropods (*Hemiplecta, Amphidromus, Cyclophorus, Pila*) the top of the spire has been broken away in order to give the consumer easy access to the juicy content. Only the *Melania* do not bear any trace of crushing, the shells being quite entire, save for the usual erosion of the initial whorls, a common feature among these animals, and with the exception of the presence of round holes in the newest part of the last coil at a little distance from the aperture (rarely in earlier whorls) about which mention will be made later.

With regard to these *Melania* I venture to suppose that the bodies may have been extracted from the shells by way of the aperture, in a manner more or less similar to that in which modern people in Europe eat periwinkles with the help of a pin. For this purpose however, the snails must necessarily have been first plunged into boiling water; otherwise the powerful columellar muscle would prevent extraction.

The *Melania* shells containing drilled holes may perhaps have been used for ornament as is the case with the marine specimens mentioned above. In

some others the outer lip of the aperture is partly broken; whether this is only accidental, or whether it points to a drilling experiment that failed, cannot be definitely decided.

In the Lamellibranchs, as far as they have been shattered, invariably the siphonal region of the valves is missing to a larger or smaller extent. Apparently the people duly recognised this posterior end as the most fragile part of the shell. For the systematist it is a great advantage that thus the most important hinge and umbonal area have been preserved, facilitating an exact identification in most cases.

The opening is perhaps effected by pounding with a large stone; at any rate in my opinion it points to the fact that the mussels were consumed raw. If they had been cooked, the shells would have come off unbroken as for that purpose the whole animal is simply plunged into hot water where shell and flesh easily separate. Nor seems roasting to have been the custom as the valves do not show the slightest trace of blackening by fire.

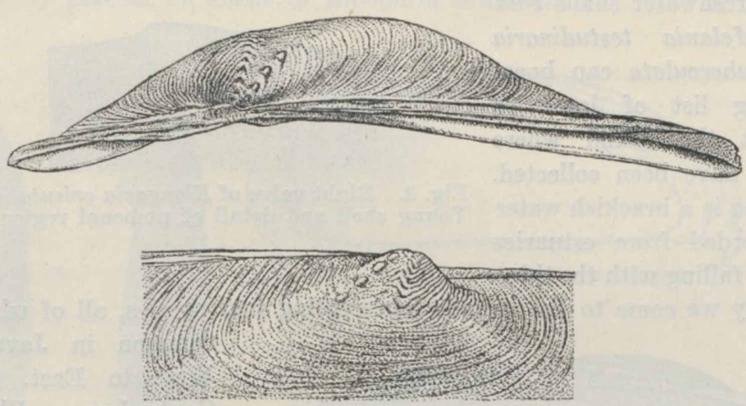


Fig. 1. Right valve of *Contradens contradens* (LEA). Detail of umbonal region showing structure (× 3).

In addition to these notes on the use of the shells for ornament and food a few remarks on the purely malacological side of the question may be added.

We have already seen that the condition in which the shells were discovered in the cave deposits is excellent. Among the non marine mollusca which alone will occupy us here further, the majority of the Gastropods still bears more or less distinct colour markings; the Cyclophorids and *Amphidromus filozonatus* especially look as fresh as if they were only recently dead. In the Najads the umbonal sculpture is preserved on several valves, and the nacreous layer on the inside is still glossy.

Now, it is easy to understand that the age of these prehistoric deposits cannot be considered very great; according to finds of implements and pottery they have been estimated to date from about 1000 years B.C.

Therefore it is impossible that the species of mollusca found in the cave are fossil; moreover the little list in the beginning of this paper bears only

names still represented in the actual Javanese fauna. And what is more, even in the much older Trinil beds in Central Java all non marine mollusca, except one, belong to recent species.

Nowadays *Hemiplecta javanica* and *Plectotropis rotatoria* inhabit the whole island of Java from sealevel up to 1800 m in the mountains. The same area is also frequented by *Cyclophorus perdix,* one of the commonest species of Java. *Amphidromus filozonatus,* however, is restricted to East Java where it occurs only in the lowland zone.

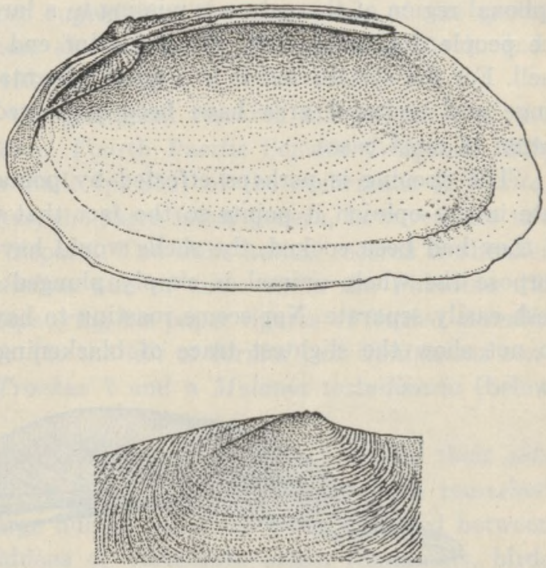


Fig. 2. Right valve of *Elongaria orientalis* (LEA). Young shell and detail of umbonal region (× 2).

The freshwater snails *Pila conica, Melania testudinaria* and *M. tuberculata* can boast of a long list of localities throughout the island where specimens have been collected. *Cyrena* is a brackish water form, recorded from estuaries rising and falling with the tides.

Finally we come to the Najads representing four species, all of which are common in Java from West to East. Of the *Contradens, Elongaria* and *Rectidens* many valves show distinct sculpture on the beaks as the accompanying figures demonstrate (fig. 1 tot 4)

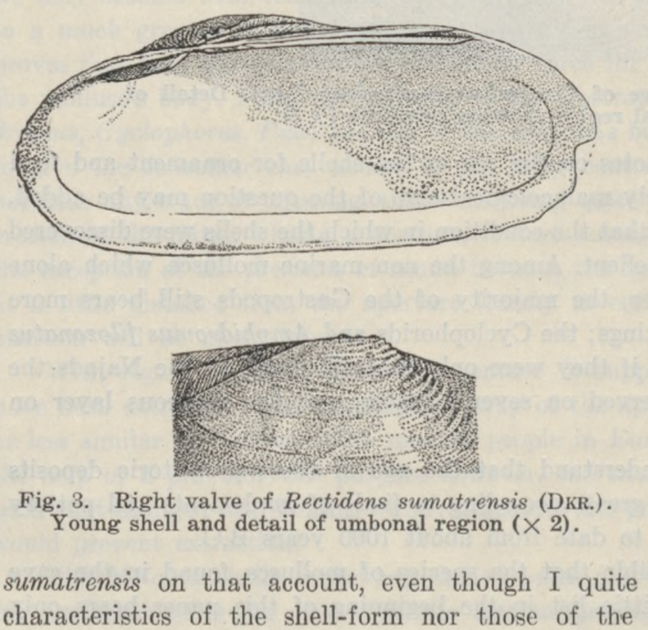


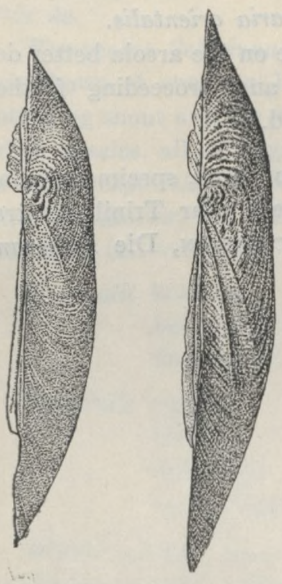
Fig. 3. Right valve of *Rectidens sumatrensis* (DKR.). Young shell and detail of umbonal region (× 2).

In *Elongaria orientalis* and *Rectidens sumatrensis* this umbonal structure is very similar (fig. 2-4) and so closely do they resemble each other that at first I planned to unite all those valves to *Rectidens sumatrensis* on that account, even though I quite realised that neither the characteristics of the shell-form nor those of the hinge armament were in

accordance. The more I was inclined to do so as Haas (Martini & Chemnitz, N. Syst. Conch. Cab. Bd. IX, Abt. 2 II, 1910, p. 168 etc.), in his description of *Elongaria orientalis* explicitly denies the presence of any umbonal sculpture (ohne erkennbare Skulptur), this being moreover one of the grounds for separating subgenerically the smooth *Elongaria* (*Elongaria*) *orientalis* from the plainly sculptured Bornean *Elongaria* (*Nannonaia*) *trompi*.

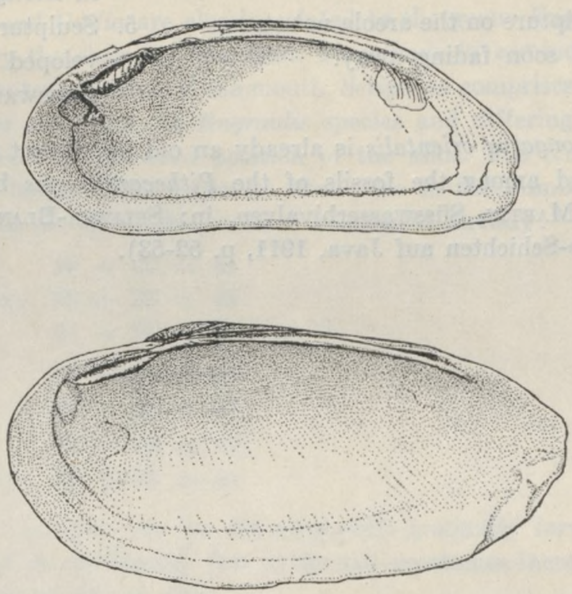
If we compare, however, the original diagnosis by Lea, also quoted in Haas' Monograph, we find that "the umbonial slopes bear two raised lines" and that the beaks are "slightly prominent, with small undulations at the tip". Similar features are also mentioned by Mousson (Land- und Süsswasser-Mollusken von Java, 1849, p. 93) in the diagnosis and further description of his *Unio productus* (afterwards drawn into the synonymy of *E. orientalis*) when saying: "Concha .... obsolete rugosiuscula".

These discoveries compelled me to give up Haas' conception and to do justice to the author of the species by acknowledging that an umbonal structure is positively present on shells of *Elongaria orientalis*.



A. B.

Fig. 4. Right valves of A. young *Elongaria orientalis* (Lea) and B. *Rectidens sumatrensis* (Dkr.); seen from the dorsal side showing umbonal structure (× 2).



A.

B.

Fig. 5. Right valves of A. *Elongaria orientalis* (Lea) and B. of *Rectidens sumatrensis* (Dkr.). Adults; natural size.

In this way I was lead to a more satisfactory discrimination of the puzzling shells. The most obvious characteristics can be summarised in the following table (fig. 5):—

Elongaria orientalis (LEA).	*Rectidens sumatrensis* (DKR.).
1. Shell with rounded dorsal side, falling down notably towards the posterior end where it meets the nearly horizontal, or slightly concave, base.	1. Shell more elongate, dorsal and ventral margins stretching in similar curve to a pointed siphonal end.
2. Cardinals strong and compact and much grooved.	2. Cardinals weaker and more drawn out, not so strongly grooved.
3. Cardinal of right valve stretching forward from the point where the top of the umbo meets the hinge.	3. Cardinal of right valve beginning anteriorly from the meeting point of umbo and hinge line.
4. Umbonal crests weak and rapidly fading away. Angle between hinge line and outer crest larger than in *Rectidens sumatranus*.	4. Umbonal crests well developed and continuing strongly a long way down. Angle between hinge line and outer crest smaller than in *Elongaria orientalis*.
5. Sculpture on the areola not strong and soon fading away.	5. Sculpture on the areola better developed and proceeding farther downward.

Elongaria orientalis is already an old inhabitant of Java, specimens being recorded among the fossils of the *Pithecanthropus* beds near Trinil, Central Java (MARTIN, Süsswasserbivalven, in: SELENKA-BLANCKENHORN, Die *Pithecanthropus*-Schichten auf Java, 1911, p. 52-53).

FISH EGGS AND LARVAE FROM THE JAVA SEA [1])

By

Dr. H. C. DELSMAN

(Laboratorium voor het Onderzoek der Zee, Batavia).

19. The genus Setipinna.

In nrs. 12 and 17 of this series I have dealt with the eggs and larvae of the genera *Engraulis* and *Stolephorus* resp. We have seen that the eggs of the Indian species belonging to the former genus are round or practically so whereas the eggs of the various *Stolephorus* species have an elongated shape. The eggs of *Stolephorus* may or may not contain an oil-globule, whereas those of *Engraulis* never do.

The genera *Setipinna* and *Coilia* are closely related to the genus *Engraulis* as is shown at once e.g. by the shape of the head. They have in common the protruding snout and the ventral position of the mouth. *Setipinna* comprises three Indian species, all of larger size than the *Engraulis* species and differing from the latter especially by the more forward position of the anus. The trunk is relatively shorter, the tail longer. This expresses itself also in the numbers of trunk and tail vertebrae. In nr. 12 of this series I mentioned already

Engraulis baelama	19 + 22 = 41
„ *kammalensis*	18 + 23 = 43
„ *dussumieri*	17 + 24 = 41
Engraulis mystax	21 + 24 = 45
„ *Grayi*	20 + 25 = 45
„ *setirostris*	19 + 26 = 45
„ *valenciennesi*	18 + 26 = 44

Within each of these two series we see the anus shift gradually forwards, the number or trunk myotomes decreasing, that of the tail myotomes increasing.

For the three *Setipinna*-species we find

Setipinna taty	15 + 31 = 46,
„ *melanochir*	18 + 32 = 50,
„ *breviceps*	17 + 37 = 54, and for
Lycothrissa crocodilus	19 + 31 = 50.

In the genus *Stolephorus* the numbers of trunk- and of tail vertebrae are nearly alike, as a rule the number of trunk vertebrae slightly surpassing that of

[1]) cf. Treubia Vol.II, p.97; Vol.III, p.38; Vol.V, p.409; Vol.VI, p.297; Vol.VIII, p.199 and p.389; Vol.IX, p.338; Vol.XI, p.275; Vol.XII, p.37 and 367; Vol.VIII, p.217 and 401.

the tail vertebrae and being relatively lowest in the less slender species occurring nearest the coast or penetrating furthest into the brackish water of the river mouths. In the genus *Engraulis*, where the body is higher and more laterally compressed, the number of tail vertevrae is higher that that of the trunk vertebrae and this is still considerably more the case in the brackish water genera *Lycothrissa* and *Setipinna*, where at the same time the body is still higher and still more laterally compressed.

We see here the same phenomenon of a precession of the anus as may be observed in comparing the genera *Clupea, Pellona, Opisthopterus* and *Raconda* where we find the following numbers of vertebrae:

Clupea (Indian species)	26 - 32 + 14 - 18 = 42 - 47
Pellona	18 - 22 + 23 - 30 = 42 - 50
Ophisthopterus	17 - 19 + 33 - 35 = 50 - 54 [1])
Raconda susselliana	19 + 42 = 61

In *Clupea* the number of trunk vertebrae is considerably higher than that of the tail vertebrae, in *Raconda* the latter has risen to more than two times the number of trunk vertebrae.

Looking now at the eggs within these two series, viz. within the subfamily of the *Engraulinae* and that of the *Clupeinae*, we see that in general the more pelagic species have no oil-globule, the more neritic ones have one or even more. This can be observed within the genera *Stolephorus* and *Clupea*. With the Indian species of the genus *Engraulis* no oil-globule seems ever to occur in the eggs. Quite similar eggs, however, w i t h oil-globules were found to belong to the genera *Setipinna* and *Coilia*.

During his stay at Bagan Si Api-Api Dr. HARDENBERG found that of the three species of *Setipinna* the one going furthest up the river is *Setipinna melanochir*, soon followed by *Setipinna breviceps*. Often these two species are caught together, not only at Bagan but also, as we found afterwards, in the mouth of the Kumai (Borneo) and other rivers. *Setipinna taty* seems to occur somewhat more outward. At the village of Kumai, e.g., situated on the Kumai river (Borneo) some 10 miles from the mouth, we saw *Setipinna melanochir* together with a few *Setipinna breviceps* being caught with a seine-net in water with a salinity of no more than 7.5 ‰. At a place nearer to the mouth of the Kumai, however, *Setipinna* breviceps dominated in the catch.

On April 27th, 1930, I found in a horizontal surface catch made in the river Kumai two eggs which, by their segmented yolk, might be recognized at once as belonging to some herring-like fish. Further they were characterized by the presence of a relatively enormous, colourless, oil-sphere, accompanied by a number of smaller ones. The salinity at that place was 17.4 ‰ and the plankton consisted chiefly of *Ceratium fusus* (which is else a less common form in Indian plankton) and *Noctiluca*.

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[1]) We found for the number of vertebrae in: *Opisthopterus tartoor* 17 + 33 = 50.
„ *macrognathus* 19 + 35 = 54.

The diameter of the two eggs was 1 mm, that of the big oil-globule slightly more than ½ mm. They contained, at 9 a.m., an embryo ready to hatch. Indeed hatching occurred slightly after. One of the larvae died, the other, fixed at 5 p.m., is shown in fig. 2. It is of the usual herringlike type, with 38 + 16 myotomes. The yolk is pear-shaped, tapering gradually hindward, as is the case with many herring-like fishes (Treubia XI, p. 283-284) but not with the genera *Clupea, Clupeoides* and *Dorosoma* (cf. Treubia VIII, p. 218 and 389). The big oil-sphere is situated in the anterior part of the yolk, the small ones more backward.

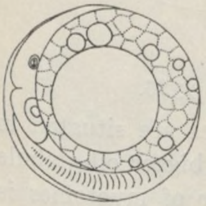

Fig. 1. Egg of *Setipinna melanochir*, × 2.

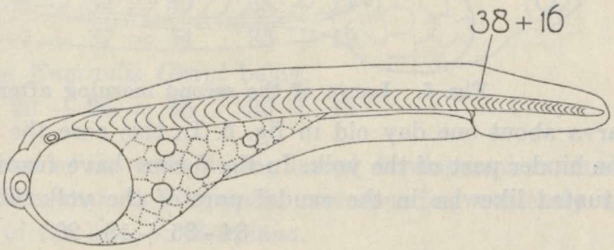

Fig. 2. Newly hatched larva, × 26.

My suspicion that this egg belonged to a *Setipinna* — *Setipinna melanochir* and *breviceps* being caught there regularly — was confirmed by the examination of a very ripe specimen of *Setipinna melanochir* caught at Kumai in the afternoon. The ovarial eggs had already swollen up to their definitive size, being even slightly larger than the two mentioned above. They contained the big oil-globule, together with a few smaller ones, so characteristic of the two pelagic eggs. This proves, then, that the latter indeed belong to *Setipinna melanochir*. In May 1931 I have tried in vain to get more or these eggs in the Kumai mouth nor did I ever find them elsewhere.

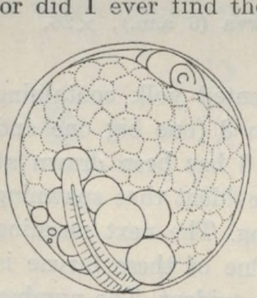

Fig. 3. Egg of *Setipinna breviceps*, × 26.

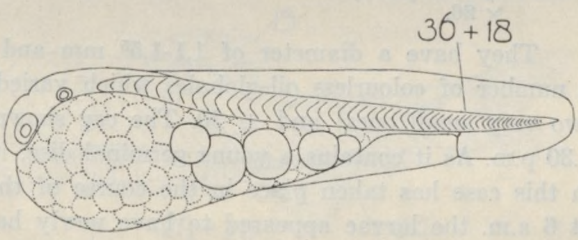

Fig. 4. Newly hatched larva, × 26.

A more common egg in the Kumai mouth is the one which I feel inclined to ascribe to *Setipinna breviceps*. It has a diameter of 1,2-1,2[5] mm and segmented yolk containing a number of colourless oil-globules of different sizes. These oil-globules are situated ventrally near the tail. The shape of the egg is not perfectly globular, a phenomenon to be observed also with the Indian *Engraulis* eggs. Round the embryo and the yolk a thin inner egg membrane may be observed (fig. 3).

I caught these eggs in the Kumai mouth in October 1930 and in May 1931. The salinity of the water varied in May 1931 between 16.8 and 18 $^0/_{00}$, in October 1930 between 25.5 and 27.9 $^0/_{00}$. In the latter case the eggs hatched at 11 a.m., in the former at 9-10 a.m. A newly hatched larva is shown in fig. 4, a

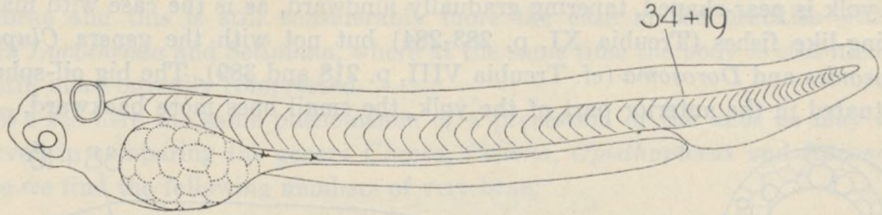

Fig. 5. Larva of the second morning after hatching, × 26.

larva about one day old in fig. 5. In this case the oil-globules are situated in the hinder part of the yolk. In fig. 5 they have fused into one bigger oil-globule situated likewise in the caudal part of the yolk. The number of myotomes is

34 - 36 + 18 - 20

In the larva of fig. 5 a few black pigment spots were present above the gut.

Setipinna taty, finally, is a species common e.g. near Surabaya. Here I found the eggs to be described now, in water with a salinity of about 26 $^0/_{00}$.

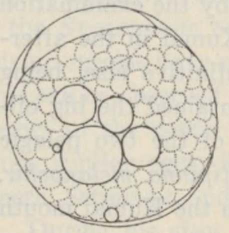

Fig. 6. Egg of *Setipinna taty* (1.30 p.m.), × 26.

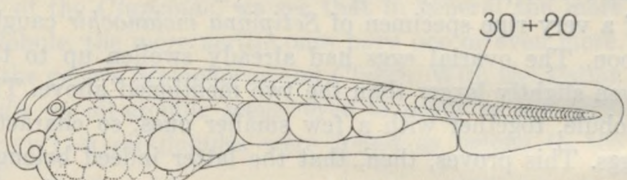

Fig. 7. Newly hatched larva (6 a.m.), ×26.

They have a diameter of 1,1-1,5[5] mm and a segmented yolk containing a number of colourless oil-globules which varied between 3 (one big one and two very small ones) and ± 20. The egg shown in fig. 6 has been drawn at 1.30 p.m. As it contains a young germinal disc, it seems evident that spawning in this case has taken place in the course of the morning. The next morning at 6 a.m. the larvae appeared to have newly hatched. One of these larvae is shown in fig. 7. The affinity to the one shown in fig. 4 is evident. The number of myotomes, however, is different. We count 30 + ± 20 and in the slightly older larva of fig. 8, 29 + 17. This is the lowest number found in the threc

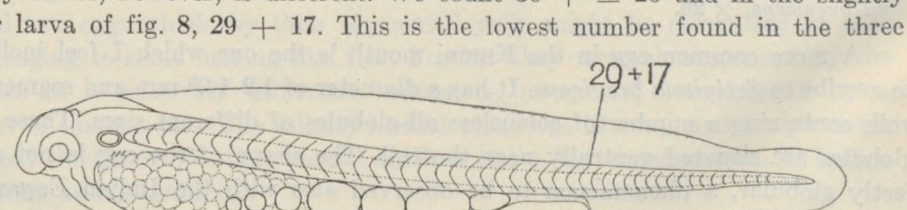

Fig. 8. Larvaof the next day, with rudiment of pectoral fin, × 26.

eggs dealt with in this article and thus tallies well with our supposition that this egg belongs to the *Setipinna* with the lowest number of vertebrae, viz. *Setipinna taty*.

If our conclusions thus far are right, we find for the numbers of vertebrae in the adult as compared with the numbers of myotomes in the larvae.

	adult	larva
Setipinna taty	15 + 31 = 46	29 + 17
„ *melanochir*	18 + 32 = 50	38 + 14 [1])
„ *breviceps*	17 + 37 = 54	35 + 19

the same values e.g. for *Engraulis Grayi* being:

Engraulis Grayi	20 + 25 = 45	30 + 15

We see that the precession of the anus during larval development is much more considerable in *Setipinna* than in *Engraulis*, corresponding evidently to the phylogenetic precession of the anus in *Setipinna*.

Regarding the eggs of *Setipinna* in general we may conclude by stating that they look much like those of *Engraulis*, being round but not perfectly and having a similar diameter. The difference, however, is that the *Engraulis* eggs are without oil-globule, whereas the *Setipinna* eggs contain a varying number of them. The *Setipinna* eggs are found in water of a lower salinity than those of *Engraulis*.

Finally I give a few figures of older larvae, caught in the egg net (figs. 9 and 10). They look much like herring- and anchovy-larvae but may be easily distinguished from the latter by the considerable number of fin-rays in the anal fin which also allows us to identify the species.

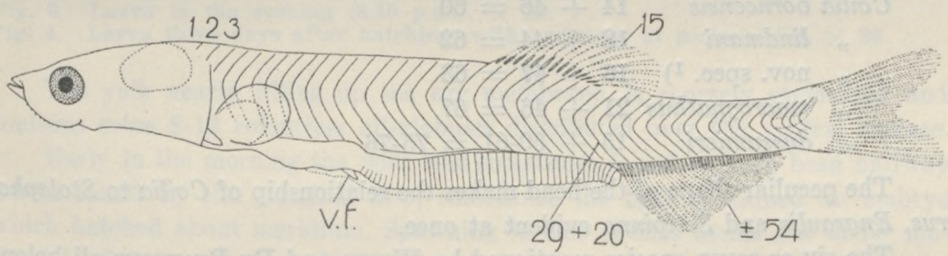

Fig. 9. Larva of *Setipinna taty*, length 11 mm.
East coast of Sumatra, June 1923.
v.f. rudiment of ventral fin.

The number of trunk myotomes in the larva of *Setipinna taty* (fig. 9) is still the same as in that of fig. 8, in a larva of 16½ mm, however, it had sunk to 27.

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[1]) In newly hatched larvae of herring-like fishes we find as a rule a few more tail-myotomes than in the slightly older ones. For that reason I have taken here a slightly lower number than that of fig. 2.

In the larva of *Setipinna breviceps* (fig. 10) it has sunk from 35 (fig. 5) to 33. The origin of the anal fin, in fig. 9 as well as in fig. 10 situated close behind the end of the dorsal fin, will during further development move forward

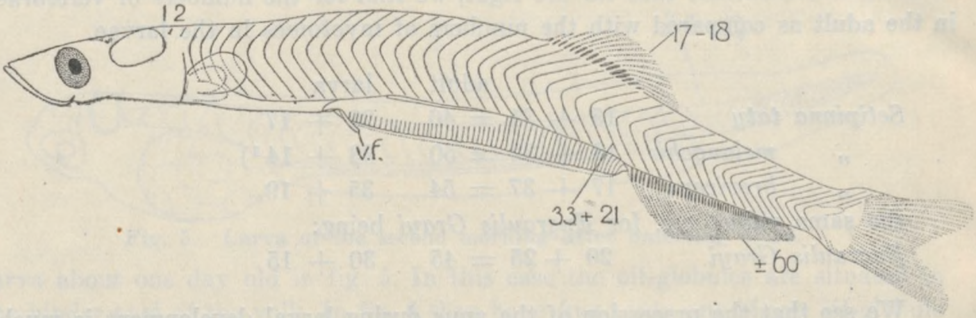


Fig. 10. Larva of *Setipinna breviceps*, length 16 mm. Road of Tandjong Balei (Sumatra), June 1923. *v.f.* rudiment of ventral fin.

until in the adult *Setipinna taty* it lies under the dorsal fin and in the adult *Setipinna breviceps* even in front of the origin of the latter.

In both larvae the rudiment of the ventral fins has just appeared.

20. The genus Coilia.

The precession of the anus and more especially the lengthening of the tail which is to be observed in *Setipinna* has proceeded still further in *Coilia.* This phenomenon expresses itself in the numbers of vertebrae as well. We found e.g. for

Coilia borneensis	14 + 46 = 60
„ *lindmani*	18 + 44 = 62
„ nov. spec. [1])	16 + 47 = 63
„ *macrognathus*	21 + 46 = 67
„ *dussumieri*	15 + 60-61 = 75-76

The peculiar shape of the head makes the relationship of *Coilia* to *Stolephorus, Engraulis* and *Setipinna* evident at once.

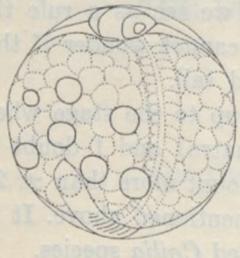
The six or seven species mentioned by WEBER and DE BEAUFORT all belong to the brackish or even fresh water fauna and are mainly restricted to the river mouths of Sumatra and Borneo. The only *Coilia* species known from the Java coast is *Coilia dussumieri* which is common near Surabaja and Gresik only, and which is also the commonest form at Bagan Si Api-Api (Rokan mouth, Sumatra). At the Batavia fish market *Coilia* is wholly unknown.

Now I have often found near Bagan as well as near Gresik, and also in Amphitrite Bay (Indragiri mouth, Sumatra) eggs reminding one of *Engraulis* and *Setipinna* eggs and which evidently must be attributed to *Coilia.*

[1]) Received by Dr. HARDENBERG from Pontianak.

The salinity of the water in which these eggs were fished varied as a rule between 27 and 30 ‰. Near Gresik, however, October 1930 — at the end of the east monsoon —, I found them in water with a salinity of no less than 34 ‰. The diameter in the latter case was 1 mm. In the catches from water of lower salinity it amounted to 1,05-1,1 mm.

1



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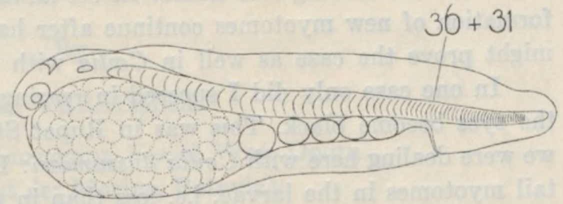

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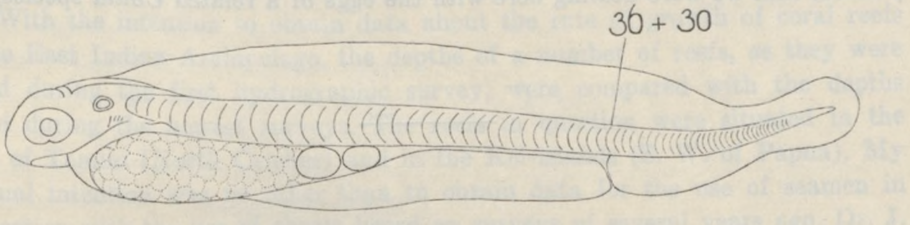

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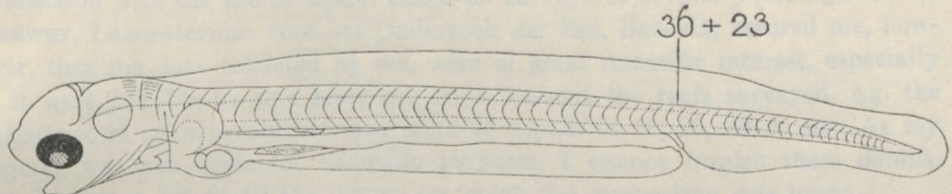

Fig. 1. Egg of *Coilia* from Amphitrite Bay, 7.30 a.m., × 26.
Fig. 2. Newly hatched larva (at meridium), × 26.
Fig. 3. Larva in the evening (8.30 p.m.), × 26.
Fig. 4. Larva three days after hatching, with rudiment of pectoral fin, × 26.

The yolk nearly filling up the egg membrane, is coarsely segmented and contains some 8-12 colourless oil-globules distributed over the ventral surface.

Early in the morning the yolk was sometimes found to have been halfway grown round by the germinal disc, sometimes the eggs contained an embryo which hatched about meridium. Spawning in this species seems not to be confined to the evening hours but not rarely to occur in the course of the day or even of the morning so that stages with a young germinal disc were often caught in the day hauls.

The larvae hatching from these eggs do not differ in any respect from the usual type of herring-like fishes. The number of myotomes is considerable. I counted as a rule 36 trunk myotomes. The number of tail myotomes could not be determined with sufficient accuracy, the myotomes becoming gradually less distinct. As far as nr. 25 they were distinct at any rate. More backward it was often difficult to make out where to end counting. Sometimes I could count up to 30, in one case even up to 37, incl. the unsegmented terminal part.

Most of my observations on the egg and newly hatched larvae probably relate to *Coilia dussumieri.* We see, then, that the total number of myotomes in the larvae as a rule remains below the total number of vertebrae in the adult. We have to assume that the formation of myotomes at the tail end has not yet been completed at the moment of hatching. As a rule this is the case with herring-like fishes. In eel-larvae, however, we see as a rule the formation of new myotomes continue after hatching. We cannot wonder if this might prove the case as well in *Coilia* with its elongated tail.

In one case only did I succeed in rearing the larvae up to the stage when the eyes become black. This was in Rupat Straight (Sumatra) and I doubt if we were dealing here with *Coïlia dussumieri*: I could not count more than $\pm$ 23 tail myotomes in the larvae, i.e. less than in the larvae mentioned above. It is possible that we were dealing here with the eggs of a related *Coilia* species.

THE GROWTH RATE AT VARIOUS DEPTHS OF CORAL REEFS IN THE DUTCH EAST INDIAN ARCHIPELAGO.

By

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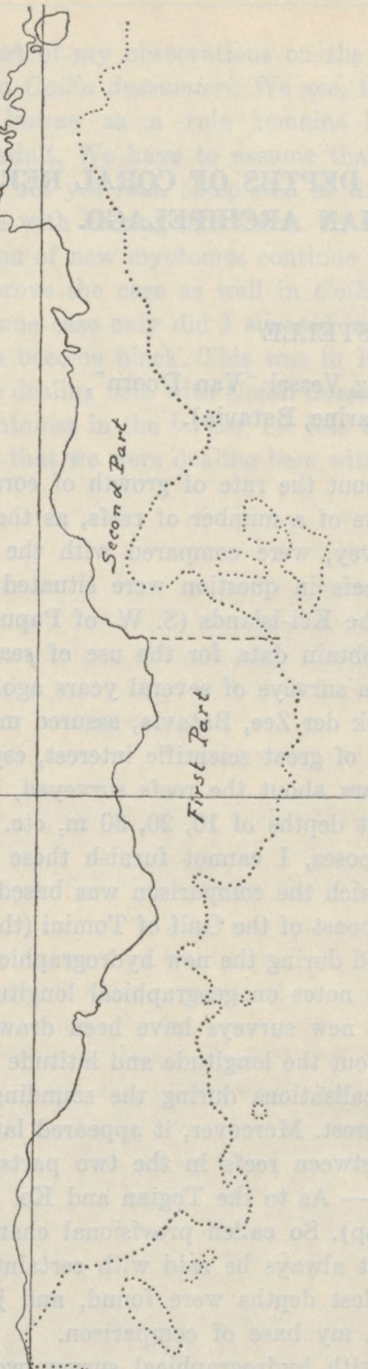
(1st Officer dutch Surveying Vessel "Van Doorn", Departement der Marine, Batavia).

With the intention to obtain data about the rate of growth of coral reefs in the East Indian Archipelago, the depths of a number of reefs, as they were found during the first hydrographic survey, were compared with the depths found during the newest surveys. The reefs in question were situated in the Gulf of Tomini (North Celebes) and in the Kei-islands (S. W. of Papua). My original intention was no other than to obtain data for the use of seamen in connection with the use of charts based on surveys of several years ago. Dr. J. Verwey, Laboratorium voor het Onderzoek der Zee, Batavia, assured me, however, that the data collected by me, were of great scientific interest, especially if it were possible to give more particulars about the reefs surveyed, e.g. the difference in growth rate between reefs at depths of 10, 20, 30 m, etc. As my inquiry was not made for scientific purposes, I cannot furnish these details, but I insert a list of all the figures on which the comparison was based.

My notes concerning the reefs of the coast of the Gulf of Tomini (the Bight of Tomini) have been successively gathered during the new hydrographic survey (1930-'31). In collecting them I made no notes on geographical longitude and latitude of the reefs and as the old and new surveys have been drawn on a different scale, it is very difficult to find out the longitude and latitude of each reef among the tens of thousands of localisations during the sounding work. These data were in my opinion of no interest. Moreover, it appeared later that the difference in average growth rate between reefs in the two parts of the Gulf of Tomini is not worth mentioning. — As to the Togian and Kei Islands, however, the positions are given (see map). So called provisional charts were not used for the comparison, as it cannot always be said with certainty, that during the provisional surveys the smallest depths were found, and just the smallest dephts found on each reef form my base of comparison.

In behalf of those not acquainted with hydrographical survey work, the following particulars are given to judge about the exactness of the recorded data. Though it is generally very difficult in a hydrographical survey to say with absolute certainty that all existing dangers to navigation have been found, it may be said that the shallowest place of any reef discovered is almost



Gulf of Tomini, scale 1:333 000; .... 200 metres line.

certainly found, because it is searched for during a long time, as it is of very great interest to the sailor. — During both the early and the later surveys all depths have been reduced to the same level, lying at a certain distance below mean sea level. The vertical motion of the water in respect to mean level is calculated by harmonic analysis (constituents used: S 2, M 2, K 1, O 1, P 1, N 2, K 2). The base of comparison, then, can be considered as sufficiently correct.

It needs not be emphasized that reefs, the identity of which during both surveys could not be verified with absolute certainty, were not used for comparison. On account of the great number of newly discovered reefs, it was often difficult to obtain this certainty.

As already stated the reefs compared are situated in the Gulf of Tomini and the Kei Islands. Those in the Gulf of Tomini fall into two groups:
1. those of the Bight of Tomini,
2. those of the Togian Islands in the Gulf of Tomini.

The reefs of the Gulf of Tomini (those of the Togian Islands included) for the study of which sea charts nrs. 60 and 308 and the white prints from the new survey were used, are without exception very steep. They rise up from depths of 20 to 40 metres, while at a distance of 100 to 400 metres from the reefs on the edge of the continental shelf, depths of more than 200 m were recorded. The reefs of the Kei Islands, which were studied by comparing Dutch chart nr. 162 (Hydrog. Survey 1890) and white print 1495 (Hydrogr. Survey 1927), are not so steep.

Sketches are added of the areas in which the reefs used are situated; the order of exploration, has been from West to East. For the sake of convenience the material available is divided as given below.

It should be stated that the average figures given for the Bight of Tomini are not quite the same as those given in De Zee, Vol. 5/1931; the reason is that I have added some figures and that some others have not been used here.

<table>
<tr><td rowspan="6">A.
TOGIAN ISLANDS</td><td rowspan="4">1° Reefs with depths during first survey of less than 3 metres</td><td rowspan="2">on the edge of continental shelf</td><td>a) rising</td></tr>
<tr><td>b) sinking</td></tr>
<tr><td rowspan="2">not on the edge of continental shelf</td><td>a) rising</td></tr>
<tr><td>b) sinking</td></tr>
<tr><td>2° Reefs with depths during first survey of 3—5 metres</td><td colspan="2">subdivided as 1°</td></tr>
<tr><td>3° Reefs with depths during first survey of more than 5 metres</td><td colspan="2">subdivided as 1°</td></tr>
<tr><td rowspan="4">B. I.
Gulf of TOMINI
(first part)</td><td colspan="2" rowspan="2">1° Reefs with depths during first survey of less than 3 metres</td><td>a) rising</td></tr>
<tr><td>b) sinking</td></tr>
<tr><td colspan="2">2° Reefs with depths during first survey of 3—5 metres</td><td>subdivided as 1°</td></tr>
<tr><td colspan="2">3° Reefs with depths during first survey of more than 5 metres</td><td>subdivided as 1°</td></tr>
<tr><td>B. II.
Gulf of TOMINI
(second part)</td><td colspan="3">subdivided as B. I.</td></tr>
<tr><td>C.
KEI-ISLANDS</td><td colspan="3">subdivided as B. I.</td></tr>
</table>

I hope that the data collected by me may serve as an addition to the knowledge of the growthrate of coralreefs in other countries.

A. TOGIAN ISLANDS. 1° DEPTHS < 3 METRES.

RISING

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of rising
I Reefs on the edge of continental shelf			
44	1,75 mr	dry	1,75
57	1,75	1,0	0,75
65	1,75	dry	1,75
70	2,75	2,50	0,25
71	1,75	1,50	0 25
			4,75

Mean per annum: $\frac{475}{5\times24} = 4{,}0$ cm

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of rising
II Reefs not on the edge of shelf			
27	1,75	dry	1,75
32	1,75	dry	1,75
59	1,75	1,50	0,25
67	1,75	dry	1,75
			5,50

Mean per annum: $\frac{550}{4\times24} = 5{,}7$ cm

Mean of I and II : 4,7 cm p.a.

SINKING

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of sinking
I Reefs on the edge of continental shelf			
7	1,75	2,0	0,25
11	1,75	2,0	0,25
20	dry	1,50	1,50
22	dry	0,25	0,25
23	dry	0,50	0,50
24	dry	1,00	1,00
43	1,75	2,00	0,25
			4,00

Mean per annum: $\frac{400}{7\times24} = 2{,}4$ cm

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of sinking
II Reefs not on the edge of shelf			
15	1,75	2,50	0,75
29	1,75	2,00	0,25
31	2,75	3,00	0,25
33	1,75	3,50	1,75
36	1,75	4,00	2,25
38	dry	1,00	1,00
42	1,75	2,50	0,75
50	1,75	2,00	0,25
			7,25

Mean per annum: $\frac{725}{8\times24} = 3{,}8$ cm

Mean of I and II : 6,3 cm p.a.

A. TOGIAN ISLANDS. 2° DEPTHS 3-5 METRES.

RISING

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of rising
I Reefs on the edge of continental shelf			
8	3,50	0,25	3,25
25	3,50	dry	3,50
66	3,50	0,50	3,00
			9,75

Mean per annum: $\frac{975}{3\times24} = 13{,}5$ cm

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of rising
II Reefs not on the edge of shelf			
34	3,50	2,00	1,50
37	3,50	2,00	1,50
54	4,50	3,50	1,00
58	3,50	1,00	2,50
62	3,50	dry	3,50
			10,00

Mean per annum: $\frac{1000}{5\times24} = 8{,}3$ cm

Mean of I and II : 10,3 cm

SINKING

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of sinking
I Reefs on the edge of continental shelf			
19	3,50	4,00	0,50
21	3,50	5,00	1,50
			2,00

Mean per annum: $\frac{200}{2\times24} = 4{,}2$ cm

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of sinking
II Reefs not on the edge of shelf			
48	4,50	6,00	1,50
61	3,50	6,00	2,50
			4,00

Mean per annum: $\frac{400}{2\times24} = 8{,}3$ cm

Mean of I and II : 6,3 cm

A. TOGIAN ISLANDS. 3° DEPTHS > 5 METRES

RISING

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of rising
	I Reefs on the edge of continental shelf		
1	5,50	2,50	3,00
2	9,00	dry	9,00
4	7,25	4,00	3,25
6	9,00	5,00	4,00
9	7,25	5,50	1,75
10	9,00	3,00	6,00
12	9,00	5,00	4,00
14	5,50	3,00	2,50
16	14,50	13,00	1,50
17	5,50	3,50	2,00
18	7,25	7,00	0,25
41	6,25	6,00	0,25
52	6,25	6,00	0,25
53	6,25	6,00	1,25
68	5,50	dry	5,50
69	10,75	1,00	9,75
			54,25

Mean per annum $\frac{5425}{16\times24}$ = 14,1 cm

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of rising
	II Reefs not on the edge of shelf		
3	5,50	4,00	1,50
13	5,50	4,00	1,50
26	7,25	2,50	4,75
28	9,00	6,00	3,00
30	9,00	7,00	2,00
35	5,50	1,50	4,00
49	10,75	1,00	9,75
51	9,00	8,00	1,00
55	10,75	7,00	3,75
63	5,50	dry	5,50
			36,75

Mean per annum $\frac{3675}{10\times24}$ = 15,3 cm

Mean of I and II = 14,6 cm

SINKING

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of sinking
	I Reefs on the edge of continental shelf		
5	7,25	8,00	0,75
39	10,75	13,00	2,25
40	9,00	10,00	1,00
45	10,75	12,00	1,25
47	5,50	7,00	1,50
72	10,75	11,00	0,25
			7,00

Mean per annum $\frac{700}{6\times24}$ = 4,9 cm

Reef nr.	Smallest depth survey 1905	Smallest depth survey 1929	Amount of sinking
	II Reefs not on the edge of shelf		
46	7,25	8,00	0,75
56	5,50	7,00	1,50
60	5,50	7,00	1,50
			3,75

Mean per annum $\frac{375}{3\times24}$ = 5,2 cm

Mean of I and II 5,0 cm

B. GULF OF TOMINI. FIRST PART. 1° DEPTHS $<$ 3 METRES.

RISING			SINKING		
Smallest depth survey 1905	Smallest depth survey 1930	Amount of rising	Smallest depth survey 1905	Smallest depth survey 1930	Amount of sinking
0,75	0,25	0,50	1,50	2,50	1,00
dry	+ 0,75 dry	0,75	1,75	2,50	0,75
1,75	1,25	0,50	0,75	4,00	3,25
1,75	1,00	0,75	0,75	2,25	1,50
1,25	0,50	0,75	0,75	1,00	0,25
2,75	2,00	0,75			6,75
1,50	dry	1,50			
0,75	dry	0,75			
1,75	0,75	1,00			
1,25	dry	1,25			
1,75	1,50	0,25			
1,25	0,75	0,50			
1,75	1,00	0,75			
0,50	dry	0,50			
0,50	0,25	0,25			
0,75	dry	0,75			
2,75	dry	2,75			
1,50	+ 0,25 dry	1,75			
2,75	0,75	2,00			
1,75	dry	1,75			
1,75	0,75	1,00			
2,75	2,25	0,50			
1,75	dry	1,75			
0,75	dry	0,75			
2,75	dry	2,75			
0,75	dry	0,75			
1,75	1,00	0,75			
2,75	1,50	1,25			
		29,25			

Rising: Mean per annum $\frac{2925}{28 \times 25} = 4{,}2$ cm

Sinking: Mean per annum $\frac{675}{5 \times 25} = 5{,}4$ cm

B. GULF OF TOMINI. FIRST PART. 2° DEPTHS 3-5 METRES.

Rising: Smallest depth survey 1905	Rising: Smallest depth survey 1930	Amount of rising	Sinking: Smallest depth survey 1905	Sinking: Smallest depth survey 1930	Amount of sinking
3,50	1,25	2,25	3,50	4,00	0,50
3,50	2,75	0,75	3,50	4,25	0,75
3,50	1,75	1,75	3,50	5,25	1,75
3,50	3,50	0,00	3,50	3,75	0,25
3,50	2,50	1,00	3,50	4,25	0,75
3,50	2,25	1,25			4,00
3,50	dry	3,50			
3,50	2,50	1,00			
		11,50			

Rising: Mean per annum $\frac{1150}{8 \times 25} = 5{,}8$ cm

Sinking: Mean per annum $\frac{400}{5 \times 25} = 3{,}2$ cm

B. Gulf of Tomini. 3° Depths > 5 metres.

RISING			SINKING		
Smallest depth survey 1905	Smallest depth survey 1930	Amount of rising	Smallest depth survey 1905	Smallest depth survey 1930	Amount of rising
5,50	3,50	2,00	5,50	6,00	0,50
5,50	2,00	3,50	5,50	6,00	0,50
5,50	5,00	0,50	7,50	8,00	0,50
18,00	11,00	7,00	10,75	12,00	1,25
5,50	4,75	0,75	5,25	6,00	0,75
7,25	5,00	2,25	5,50	7,50	2,00
7,25	3,00	4,25	7,25	8,00	0.75
5.50	dry	5,50			6,25
7,50	6,50	1,00			
5,75	3.25	2,50			
9,50	8,00	1,50			
9,00	7,00	2,00			
9.00	7,50	1,50			
7,25	7,00	0,25			
7,25	7,00	0,25			
5,25	4,00	1,25			
		36,00			

Mean per annum $\frac{3600}{16\times25} = 9{,}0$ cm

Mean per annum $\frac{625}{7\times25} = 3{,}6$ cm

B. Gulf of Tomini. Second Part. Depths < 3 Metres.

RISING			SINKING		
Smallest depth survey 1898	Smallest depth survey 1930	Amount of rising	Smallest depth survey 1898	Smallest depth survey 1930	Amount of sinking
1,00	0,75	0,25	1,00	2,25	1,25
1,00	0,50	0,50	2,75	3,75	1,00
2,75	0,50	2,25	2,00	2,50	0,50
2,00	0,50	1,50	1,00	1,25	0,25
		4,50			3,00

Mean per annum $\frac{450}{4\times32} = 3{,}5$ cm

Mean per annum $\frac{300}{4\times32} = 2{,}3$ cm

B. Gulf of Tomini. Second Part. Depths 3-5 Metres.

3,75	0,25	3,50	
3,50	2,75	0,75	
3,75	2,00	1,75	
3,75	3,50	0,25	
4,50	1,25	3,25	
3,75	dry	3,75	
4,50	2,25	2,25	
4,50	3,25	1,25	
4,50	2,50	2,00	No sinking observed.
3,75	2,75	1,00	
3,75	dry	3,75	
3,75	0,25	3,50	
		27,00	

Mean per annum $\frac{2700}{12\times32} = 7{,}0$ cm

B. GULF OF TOMINI. SECOND PART. DEPTHS > 5 METRES.

Smallest depth survey 1898	Smallest depth survey 1930	Amount of rising
9,00	6,00	3,00
5,50	4,25	1,25
5,50	4,25	1,25
16,25	16,00	0,25
5,50	2,00	3,50
11,00	9,00	2,00
7,25	3,50	3,75
9,00	7,50	1,50
8,25	4,75	3,50
16,25	11,00	5,25
6,25	3,25	3,00
9,00	2,50	6,50
7,25	1,00	6,25
18,00	4,75	13,25
5,50	3,25	2,25
5,50	2,75	2,75
5,50	2,25	3,25
5,50	3,00	2,50
5,50	4,25	1,25
9,00	8,00	1,00
		67,25

Mean per annum $\frac{6725}{20 \times 32} = 10{,}5$ cm

Smallest depth survey 1898	Smallest depth survey 1930	Amount of sinking
7,25	8,00	0,75
9,00	10,00	1,00
		1,75

Mean per annum $\frac{175}{2 \times 32} = 2{,}7$ cm

C. KEI-ISLANDS. 1° DEPTHS < 3 METRES.

RISING

Reef nr.	Smallest depth survey 1890	Smallest depth survey 1927	Amount of rising
7	1,00	0,50	0,50
8	1,00	0,25	0.75
			1,25

Mean per annum $\frac{125}{2 \times 37} = 1{,}7$ cm

SINKING

Reef nr.	Smallest depth survey 1890	Smallest depth survey 1927	Amount of sinking
2	dry	0.25	0,25
14	0,50	3,00	2.50
			2,75

Mean per annum $\frac{275}{2 \times 37} = 3{,}7$ cm

C. KEI-ISLANDS. 2° DEPTHS 3-5 METRES.

1	3,50	3,00	0,50
6	4,00	3,50	0.50
12	5,00	4,50	0,50
			1,50

Mean per annum $\frac{150}{3 \times 37} = 1{,}4$ cm

9	3,50	4,75	1,25
15	3,53	5,25	1,75
			3,00

Mean per annum $\frac{300}{2 \times 37} = 4{,}1$ cm

C. Kei-Islands. 3° Depths > 5 metres.

Rising				Sinking			
Reef nr.	Smallest depth survey 1890	Smallest depth survey 1927	Amount of rising	Reef nr.	Smallest depth survey 1890	Smallest depth survey 1927	Amount of sinking
3	7,75	5,00	2,75	4	9,00	10,00	1,00
5	9,00	7,00	2,00				1,00
10	5,50	4,50	1,00				
11	9,00	7,50	1,50				
13	7,25	6,00	1,25				
16	6,75	6,00	0,75				
17	9,00	7,50	1,50				
18	12,50	7,00	5.50				
			16,25				

Rising: Mean per annum $\frac{1625}{8 \times 37} = 5{,}5$ cm

Sinking: Mean per annum $\frac{100}{1 \times 37} = 2{,}7$ cm

Recapitulation of the figures of interest gives the following table

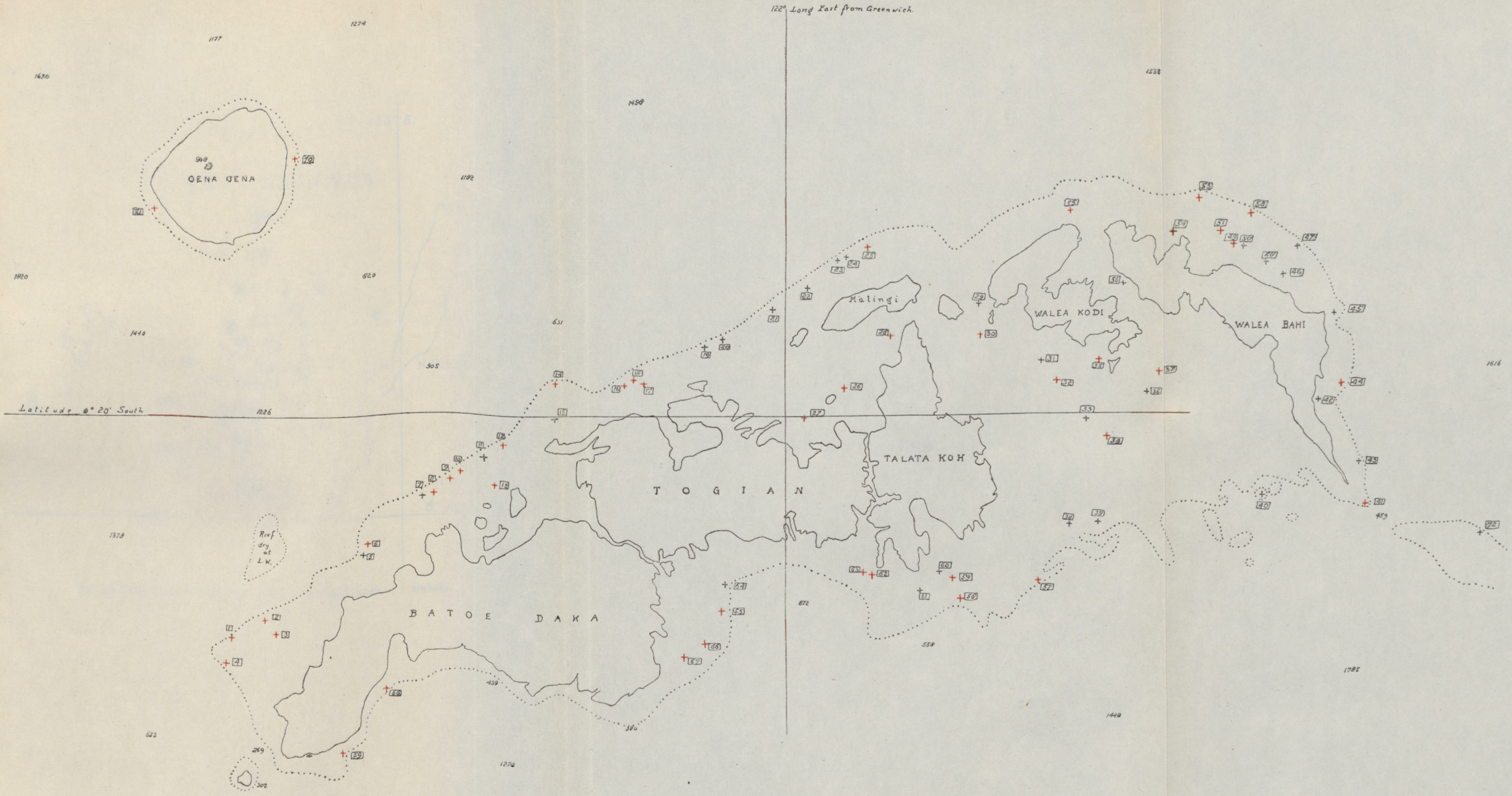
		Rising mean p.a.	Rising max. p.a.	Rising min. p.a.	Sinking mean p.a.	Sinking max. p.a.	Sinking min. p.a.
A. Togian Islands.	1°	4,7 cm	7,3 cm	1,0 cm	3,1 cm	9,4 cm	1,0 cm
	2°	10,3 „	14,6 „	4,2 „	6,3 „	10,4 „	2,1 „
	3°	14,6 „	40,6 „	1,0 „	5,0 „	9,4 „	1,0 „
B1. Gulf of Tomini, first part.	1°	4,2 „	11,0 „	1,0 „	5,4 „	13,0 „	1,0 „
	2°	5,8 „	14,0 „	0,0 „	3,2 „	7,0 „	1,0 „
	3°	9,0 „	28,0 „	1,0 „	3,6 „	8,0 „	2,0 „
B2. Gulf of Tomini, second part	1°	3,5 „	7,0 „	0,8 „	2,3 „	3,9 „	0,8 „
	2°	7,0 „	11,7 „	0,8 „	no sinking observed		
	3°	10,5 „	41,4 „	0,8 „	2,7 „	3,1 „	2,3 „
C. Kei Islands.	1°	1,7 „	2,0 „	1,4 „	3,7 „	6,8 „	0,7 „
	2°	1,4 „	1,4 „	1,4 „	4,1 „	4,7 „	3,4 „
	3°	5,5 „	14,9 „	2,0 „	2,7 „	2,7 „	2,7 „

Postscriptum by Dr. J. Verwey.

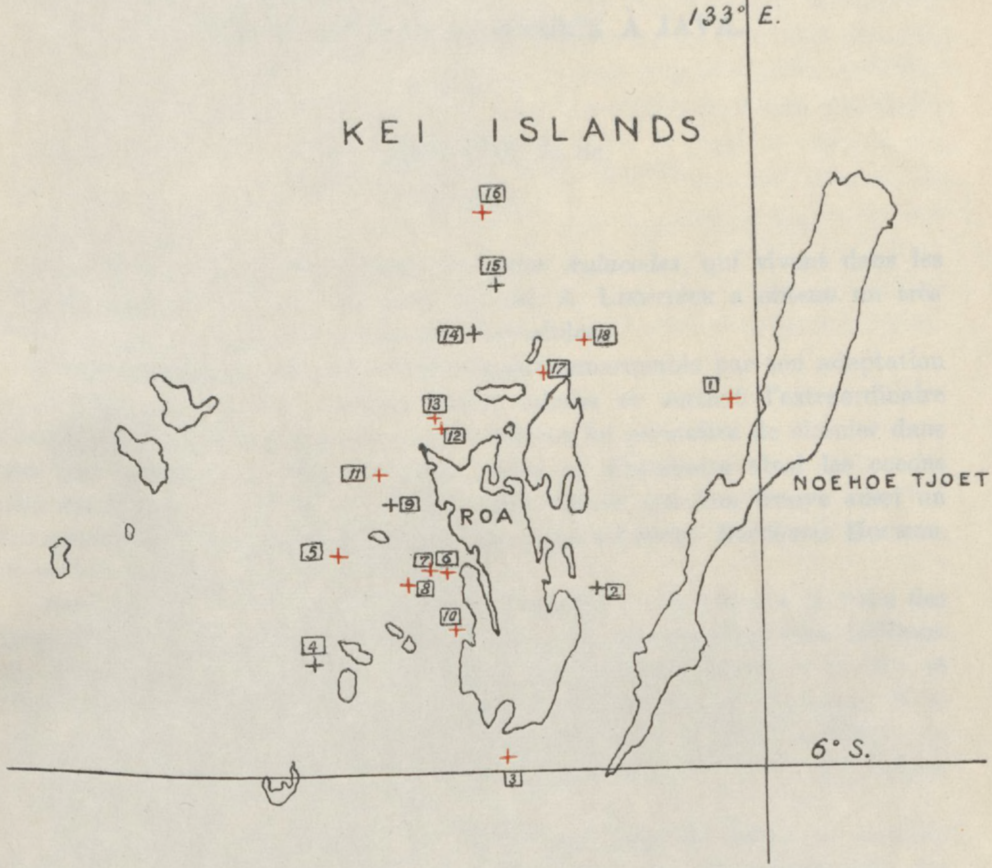
It is of much importance to know with certainty to what causes the "rising" and "sinking" of these reefs may be due. Are we dealing with growth in all cases where rising is stated, or may true rising of the bottom play a rôle? And where we see sinking: is it due to true sinking or have the corals died? — The distribution of the rising and sinking reefs shows that "rising" and "sinking" may occur in close neighbourhood of each other, so that real sinking of these reefs must be considered improbable. But moreover, it is a striking fact, that "sinking" of reefs is especially to be found near the surface,

where the influence of the surf is most important, whereas somewhat deeper it is of less importance; in the Togian Islands below 3 m hardly any sinking remains. This shows that increase of reef depth is caused by factors which influence coral growth and not by real sinking, as the latter would be the same near the surface and at greater depths. The same holds good for the rising of reefs; rising is of little importance near the surface, where the strong surf counteracts growth; it takes especially place in deeper water, where rising is of much more importance than sinking (compare the maximum for rising and sinking below 5 m!). So there can be little doubt that all rising is due to real upgrowth of the reef.

These observations, then, show, that in the Gulf of Tomini reefs below 5 m on the average grow upward as much as from 9 to 14.6 cm per year. The number of figures for the Kei Islands is too small to warrant the conclusion that their upgrowth below 5 m is not greater than 5.5 cm per year. Nevertheless it is probable that the average upgrowth of these reefs is smaller than that of the Tomini reefs. The figures for reef growth here found are high compared with those found in some other reef areas, where upgrowth has been considered to amount to 2.5 cm per year. But they agree well with figures which have been published on the growth rate of some branching corals.



Togian Islands, scale 1: 133.000; red +: rising; black +: sinking; .... 20 metres line.



Kei Islands, scale 1:1.000.000; red +: rising; black +: sinking.

UN NOUVEL ICHNEUMONIDE, PARASITE DES CHRYSALIDES AQUATIQUES d'*AULACODES* À JAVA.

Par

CH. FERRIÈRE, D. Sc.

(Londres).

En étudiant les *Hydrocampinae* du genre *Aulacodes,* qui vivent dans les eaux courantes des torrents de Java, Mr. M. A. LIEFTINCK a obtenu un très intéressant Ichneumonide, parasite des chrysalides.

Cet Ichneumonide est morphologiquement remarquable par son adaptation au milieu aquatique. Ses longues pattes minces et surtout l'extraordinaire allongement du dernier article des tarses doivent lui permettre de circuler dans l'eau peu profonde, pendant la saison sèche, et d'atteindre ainsi les cocons fixés aux pierres [1]). Mr. le Dr. ROMAN nous signale que l'on trouve aussi un allongement des tarses chez les espèces du genre européen *Meloboris* HOLMGR. qui vivent parmi la végétation des marais.

Ainsi que les *Meloboris,* l'Ichneumonide de Java appartient à la tribu des *Campoplegini.* Il est assez voisin de ce genre, mais est cependant bien différent par l'absence d'aréole aux ailes antérieures, la différente forme de la tête et de l'abdomen, et le plus grand allongement du dernier article des tarses. Il se rapproche davantage des genres *Hymenobosmina* D.T. et *Dioctes* FÖRST., en particulier par la forme de la tête, des yeux, du thorax, et par la nervulation des ailes.

Nous constatons pourtant des différences marquées entre le parasite d'*Aulacodes* et les représentants de ces deux genres. Des *Hymenobosmina* des Indes, dont nous avons vu quelques spécimens dans les collections du British Museum, il diffère par la forme de l'abdomen, moins comprimé, avec le 1er segment moins longuement pétiolé, par le propodeum plus nettement aréolé, le scutellum pas marginé, les mandibules avec les dents de longueur égale, les pattes plus minces et plus longues et les griffes non pectinées. De *Dioctes,* dont plusieurs espèces exotiques ont été décrites, principalement par MORLEY, il diffère par l'abdomen plus large, peu comprimé, le propodeum avec l'aire postérieure plus large et de courtes dents de chaque côté, les antennes plus minces, les ocelles plus rapprochés sur le vertex et les pattes plus allongées, entièrement noires, avec les tarses longs et minces et les griffes simples, non pectinées.

[1]) Mr. le Dr. BISCHOFF pense que cet allongement des tarses et des griffes permettent à ces insectes de circuler sous l'eau en s'accrochant aux plantes et aux pierres.

Ces notes étaient déjà écrites et l'espèce décrite dans un genre nouveau lorsqu'a paru une étude du Dr. H. BISCHOFF sur certains Hyménoptères des îles de la Sonde (Archiv für Hydrobiologie, IX, Trop. Binnengewässer Bd. II, 1932, p. 738-746), dans laquelle il décrit comme nouveau genre et nouvelle espèce le *Rhachioplex aulacodis* BISCHOFF, nous avons pu examiner deux cotypes de cette espèce et les comparer avec la femelle de Java. Cette dernière est très semblable et pourrait n'être qu'une variété; cependant nous relevons plusieurs différences que nous notons plus loin et nous croyons bien faire en la décrivant comme deuxième espèce de ce remarquable genre.

Rhachioplex javanicus, sp. n. (fig. 1).

♀. Corps entièrement noir, couvert d'une fine pilosité blanche, surtout abondante sur la face, les joues, les pleures et les hanches. Palpes jaunes. Mandibules noires, bout rougeâtre. Stigma et nervures des ailes bruns. Pli ventral de l'abdomen jaune à la base.

Tête étroite, finement chagrinée et pointillée, mat; yeux en ovale allongé, ocelles postérieurs plus près l'un de l'autre que du bord des yeaux. Joues très courtes. Antennes filiformes, de 38 articles; scape court, conique, plus large au bout qu'à la base; pédicelle un peu plus large que long; les articles du flagelle très minces, allongés, le 1er env. 5 à 6 fois plus long que large, les suivants graduellement plus courts, les derniers encore 2 fois plus longs que larges.

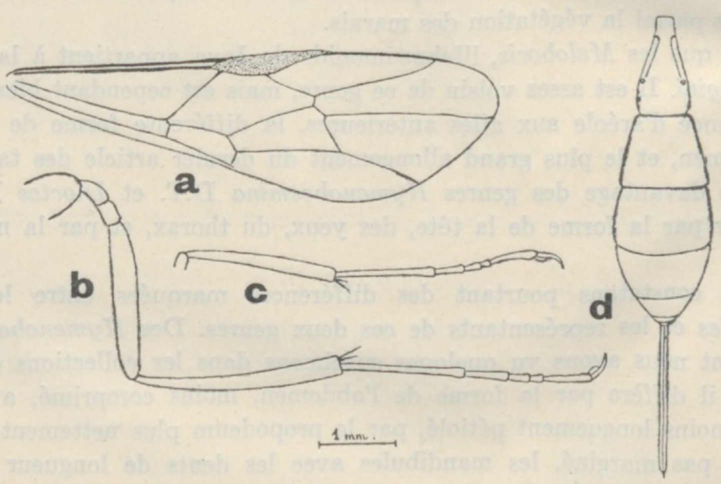


Fig. 1. — *Rhachioplex javanicus* FERRIÈRE. ♀ Java. a. Aile; b. Patte médiane; d. Abdomen. (Ch. FERRIÈRE del.).

Thorax entièrement couvert d'une ponctuation fine et serrée, mat. Mesonotum sans sillons parapsidaux, séparé du scutellum par un profond et large sillon transversal. Scutellum convexe, non caréné sur les côtés. Propodeum un peu plus fortement ponctué que le mesonotum; aires médiane et postérieure un peu ruguleuses; carènes assez fortes et élevées, formant de courtes dents sur les côtés de l'aire postérieure; costula incomplètes, plus ou moins effacées vers les

carènes latérales; stigmates courtement ovales, presque arrondis. Ailes antérieures avec le stigma mince, allongé; nervure radiale allongée, mais n'atteignant pas le bout de l'aile; extrêmité de la nervure radiale un peu relevée; nervure transverso-cubitale un peu plus courte que la distance qui la sépare de la nervure récurrente; nervure parallèle insérée un peu au dessous du milieu de la cellule brachiale; angle extérieur de la cellule discoïdale aigu; nervulus postfurcal. Ailes inférieures avec la 1ère abscisse de la nervure radiale plus courte que la nervure récurrente; nervellus droit. Pattes minces et longues, les fémurs antérieurs seuls un peu épaissis; tibias aussi longs que les fémurs, les postérieurs un peu plus longs; éperons courts, pas plus longs que le quart des métatarses; tous les tarses beaucoup plus longs que les tibias, le métatarse plus long que la moitié des tibias, le 2me article aussi long que le tiers des métatarses, le 3me article de moitié plus court que le 2me, le 4me de moitié plus court que le 3me, encore 2 fois plus long que large, le 5me article aussi long que les 3 précédents réunis ou un peu plus court aux pattes postérieures; griffes longues, minces, simples, avec de faibles denticules vers la base.

Abdomen entièrement ponctué-rugueux, épaissis après le milieu, très faiblement comprimé vers le bout; 1er segment courtement pétiolé, s'élargissant graduellement depuis avant le milieu jusqu'au postpétiole qui est un peu plus long que large; stigmates petits, arrondis, pas proéminents; 2me tergite aussi long que sa largeur postérieure; 3me un peu plus large et plus court, transverse; 4me un peu plus court que le 3me et moins large; 5me plus court et plus étroit; 6me et 7me courts et petits. Sternites courts, les 5me et 6me sternites comprimés et proéminents au dessous des 3me et 4me tergites. Tarière aussi longue que la moitié de l'abdomen, les valves un peu épaissies au bout.

Longueur: 7.5 mm.

Java occ., Tjisaroea, Mt. Panggerango, 1050 m., 1 ♀, 14. XII. 1930 (M. A. LIEFTINCK).

Hôte: Chrysalides aquatiques de la Pyralide, *Aulacodes crassicornalis* (GUEN.)

Cette espèce diffère de *R. aulacodis* BISCHOFF par les caractères suivants:

R. aulacodis. Structure générale faible, chagrinée à granuleuse, mat, sans ponctuation nette sur le mesonotum. Propodeum finement ponctué, pas ruguleux dans l'aire médiane. Abdomen chagriné-pointillé, presque lisse depuis le 3e segment; 1er segment ruguleux, striolé vers le bout.

Nervulus interstitiel; nervure transverso-cubitale env. aussi longue que la distance qui la sépare de la nervure récurrente. Tarière nettement plus courte que la moitié de l'abdomen.

Palpes blancs; fémurs avec une tache rouge ou blanche nette à la base; pli ventral blanc avec une bande noirâtre à la base de chaque sternite.

R. javanicus. Structure générale un peu plus forte, avec une fine ponctuation sur le mesonotum et une ponctuation plus forte sur le propodeum, qui est

ruguleux dans les aires médianes et postérieures. Abdomen entièrement pointillé, plus fortement sur les deux premiers segments, le 1er non strié au bout.

Nervulus nettement postfurcal; nervure transverso-cubitale nettement plus courte que la distance qui la sépare de la nervure récurrente. Tarière aussi longue que la moitié de l'abdomen.

Palpes jaunes; fémurs sans tache nette à la base; pli ventral clair à la base, avec une bande noire à la base du 2e sternite, les sternites suivants noirs.

REMARKS UPON THE EARLY STAGES OF *AULACODES CRASSICORNALIS* (GUEN.) AND ITS PARASITE *RHACHIOPLEX JAVANICUS* FERRIÈRE.

By

M. A. LIEFTINCK,

(Zoological Museum, Buitenzorg).

The Hymenopterous insects collected in 1929 by members of the "Deutsche Limnologische Sunda-Expedition", during their stay in Sumatra and Java, have been worked out recently by Prof. BISCHOFF (Berlin).

Among these, a curious new Ichneumonid, named by BISCHOFF *Rhachioplex aulacodis,* gen. et spec. nov., deserves special attention because of its aquatic habitations, and by the fact that it was bred from the pupae of an aquatic Pyralid (*Aulacodes* ?), found in abundance by the German investigators while exploring the lakes and rivers of South Sumatra, along the surf-shore of the large Ranau Lake. The adults of the same species were met with on submerged stones in the bed of the Moesi River, near Tjoeroep, also in South Sumatra. In both cases the name of the host could not definitely be given, but, as we will see, it is highly probable that at least the wasps captured in the Moesi River will turn out later to be truly parasitic upon *Aulacodes* and allied genera.

Now, in December 1930, a small black Ichneumonid wasp was bred by the present writer from pupae of *Aulacodes crassicornalis* (GUEN.), one of the numerous representatives of the *Hydrocampinae*, a subfamily of the *Pyralidae* with exclusively aquatic habitations. This specimen was forwarded to Dr. CH. FERRIÈRE for identification and this gentleman at once recognized it as belonging to a previously undescribed genus of the *Campoplegini,* a description and some figures of which being sent to the editor of 'Treubia' for publication.

A few months afterwards I came across BISCHOFF's paper "Hymenoptera (excl. Formicidae und Cynipidae) der Deutschen Limnologischen Sunda-Expedition" [1]), in which the reader will find, on p. 739—742, an ample description of the above mentioned *Rhachioplex aulacodis.*

Dr. FERRIÈRE, while drawing up his notes, was still unaware of the publication of his co-worker that was completed at approximately the same time as his. But, as will appear from the re-description of the Javanese *Rhachioplex,* as it was lately received from Dr. FERRIÈRE, and printed off in the previous pages (this Volume, pp. 127-130), our insect has now proven to belong to a distinct species, for which this author has proposed the name *javanicus,* sp. n.

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[1]) Quoted *antea,* p. 128.

I wish here to express my sincere thanks to Dr. FERRIÈRE for his kind assistance in identifying our Javan parasite and for his interesting comments relating to the possible habits of *Rhachioplex*.

The accompanying figures should be compared with those offered by BISCHOFF, in the paper already quoted.

Being desirous of preparing a special report on the extraordinarily rich and equally varied insect fauna of the mountain-streams in West-Java as a whole, it is proposed not to enter into details of the life-history of *Aulacodes* and immediate allies just now, nor does it seem advisable to give a very ample description of the larva or the curiously depressed pupal cases of that interesting insect found there. My remarks will, therefore, have to be directed chiefly to the parasite, a few additional observations and figures relating to its host being given in advance.

Among the many species of *Aulacodes,* known to inhabit Java, and whose preparatory states pass through in rapidly flowing water, *A. crassicornalis* is apparently restricted to higher altitudes since no specimens have ever been found in the rivers at lower elevation, where it is replaced by *A. adjunctalis* (SNELL.), *gibbosalis* (GUEN.), and possibly several more.

Our species was found at about 1000 metres above sea-level, and first attracted our attention by the silken pupal cases, which are attached to large stones lying in the very rugged and rocky bed of the Tjisaroea, a beautiful wild mountain-stream flowing through primeval forest and coming down from the slopes of Mt. Panggerango in West Java [1]).

During the whole year this stream contains plenty of water and in several spots where the water is most rapid the larvae and pupae are met with in great abundance. In the dry season, from May until the end of September, the level is rather sunken, but nevertheless, except at the shoals, the water is almost everywhere more than knee-deep. At that time the stream allows the visitor to penetrate about half a mile or more into the interior of the forest.

The same species, *crassicornalis,* was also frequently found inhabiting other waters of similar situation on Mt. Gedeh, and was particularly numerous in the torrential stream at the foot of the Tjibeureum falls, at an altitude of about 1700 m. The adult insects were also taken at light by Dr. DAMMERMAN in the forests of the Idjen Plateau in East Java, some 950 m above sea-level.

Taken on the whole the aquatic habitation of all species of *Aulacodes* is very much the same. The adult moths are well capable of remaining below the surface of the water, and the beautifully coloured eggs are laid on the wet rocks along the water's edge, or on the boulders in mid-stream and often well

[1]) The imagoes of other species of *Aulacodes* and relatives are abundant in this locality, most of these being found resting on the foliage overhanging the stream. Besides *A.crassicornalis* two species of *Cataclysta* and one *Piletocera* were captured along the river, while *Aulacodes aureolalis* (SNELL.) and a fine species of *Parthenodes* appear also common there. Only a single specimen of *Parthenodes* (very near to *vagalis* WLK.) was bred in January, 1931, from a large cocoon that was found amidst those of *Aulacodes*, but differing from these by its elongate shape, entirely lacking pillars.

under the surface of the water. The caterpillars of all of them agree most closely in spinning thin, silken shelters in the crevices of rough stones, which are loosely attached to the substratum under which the larva hides. POULTON, in his paper mentioned below, gave an account of the observations of KERSHAW and MUIR made by these naturalists in China on *A. simplicialis* (SNELL.) [1]) (E. B. POULTON, Notes on the Life-History of *Aulacodes simplicialis,* SNELL. Proc. Ent. Soc. London, 1909, pp. XL-XLIV, text-figs.).

Although differing in a few points of perhaps less importance, my observations on *A. crassicornalis* are in full accordance with these records, and agree also with those published in a lengthy and detailed account by PRUTHI on the Indian species *A. peribocalis* (WLK.) (HEM SINGH PRUTHI, Observations on the biology and morphology of the immature stages of *Aulacodes peribocalis* WLK. (Hydrocampinae — Lepidoptera). Red. Ind. Mus., Calcutta, 30, 1928, pp. 353-356, pl. XI).

In the last paper the author describes the morphology of the caterpillar and pupa and supplies admirable figures of the immature stages, clear drawings of the intricate and strong pupal case being given as well.

For a better understanding of the matter the following brief quotations of PRUTHI's description may be of some service:—

"When the caterpillar is full grown, it starts making, under its shelter, a tough and complex cocoon in which it is to pass the pupal stage. Only a part of the larval shelter is utilized in the formation of the cocoon, and the rest is washed away when the cocoon has been constructed. The latter (pl. xi, figs. 5 & 6), unlike that of most Lepidoptera, is two layered, and is highly compressed, its lumen being just big enough to lodge the caterpillar. The cocoon is dome-shaped and is firmly cemented to the substratum along its rims (*r*), and this attachment is further strengthened by means of vertical pillars and strands (pl. xi, fig. 6, *p* & *st*). Whereas the dorsal wall of the outer layer is very tough, its ventral wall and both the dorsal and ventral walls of the inner layer are extremely thin. The central cavity of the cocoon, enclosed within the inner layer, communicates with the exterior by means of an extremely narrow and crescent-shaped slit (*em. sl.* pl. xi, fig. 5), situated in the anterior region of the dorsal surface. The head of the larva or of the pupa points towards this opening. It is through this opening that the moth emerges. The slit is so narrow that for all practical purposes hardly any water can go in through it. This opening appears to have escaped the notice of almost all previous workers. Near the anterior and posterior ends of the cocoon there are a series of holes by which the water can go in and leave the cocoon, but as will be evident from an examination of fig. 7 (pl. xi), which is a diagrammatic median longitudinal section of the cocoon, this water does not come in contact with the pupa itself. It is highly probable that the gass

[1]) $=$*A.plicatalis* (WLK.)? *Cfr.* HAMPSON, F.Br.India,Moths.IV.p.214.

dissolved in this water can reach the pupa through the two intervening thin membranes, if this be so, the formation of the cocoon illustrates an ingenious device by which the pupa remains almost dry and at the same time well supplied with air." (*l. c.* p. 355).

The outer margin of the cocoon is not, in our species, of simple form as seems to be the case in *peribocalis,* but is provided along its anterior and posterior edges with a series of very tough sucker-like pillars, descending on both ends from the dorsal wall of the cocoon and fastened down to the rock. The inner, vertical, rim of the dome is firmly attached to the stone along its entire margin, its wall being regularly perforated in front and behind by a double series of holes through which the water flows (fig. 1).

It had always struck me as strange that so many of the cocoons, when opened for examination of their contents, were found to be empty, the significance of the crescent-shaped ridge found on one side of the back of the cocoon being at first underestimated. A more careful examination of this small lobe brought to light the extremely fine emergence slit of the imago, ingeniously pre-constructed and well concealed as it is by the two flaps that enclose it. PRUTHI was the first who recognised the correct meaning of this structure.

As was also observed by MUIR in *A. simplicialis,* the shape and size of the cocoon of *crassicornalis* vary much according to the position in which it is built. This will appear also from the accompanying figures. Besides, pupal cases containing male specimens are much smaller than those lodging the bigger females.

PRUTHI's supposition (*l.c.,* p. 354, 355) of the food of the caterpillar consisting most probably of minute particles of vegetable matter suspended in the surrounding water, appears — it may be said incidentally — to be highly improbable, since the larva possesses strong and well developed mandibles most useful in scraping off the often dense growth of algae and Hepaticae (in suitable places also the leaves of the Podostemonacea *Cladopus nymani* MÖLLER) covering the stones in the bed of the stream, the older cocoons being sometimes so overgrown with these plants as to render them difficult to detect.

Turning now to the remarkable parasite of these moths, named by Dr. FERRIÈRE *Rhachioplex javanicus.*

I may first call attention to a note in Mr. MUIR's letter to Prof. POULTON that came under my notice after having successfully bred several imagoes of *Aulacodes* and a single female specimen of its parasite in the laboratory at Buitenzorg. These passages run as follows:—

"We took several pupae home and constructed a suitable breeding-case, in which we hatched out the moth, and also a large Ichneumonid. We had noticed the cocoon and emergence holes of this parasite at the time when we were collecting the material." — And: "We were not fortunate enough to observe the method of oviposition of the parasite." (*loc. cit.*).

It is thus evident that the Chinese *simplicialis* is also seriously attacked by an Ichneumonid wasp, and it would be of great interest to learn as to whether it may be generically distinct from *Rhachioplex.*

The very striking, rounded emergence h o l e s of *Rhachioplex* (fig. 1) were observed from the outset of my visits to Tjisaroea but as I first considered them to be caused by the moths themselves, I did not take notice of them until the true emergence s l i t s of the latter were discovered. This induced me to pay several more visits to that attractive spot, in order also to get the adults, but I have never been so fortunate to take any under natural circumstances. Therefore, *i.e.* on December 14, 1930, many cocoons of *crassicornalis* were brought home for breeding purposes, with the result that nearly all of them produced the moths, and only one yielded an imago of the wasp, hatched out on December 17. Unfortunately, the pupae of several others did not reach the imaginal state and remained inside the inner layer of their host's cocoon.

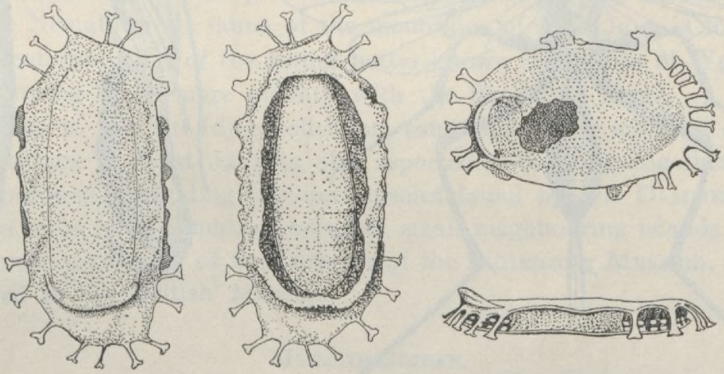

Fig. 1. — *Aulacodes crassicornalis* (GUEN.), Java. Dorsal, ventral and lateral aspect of pupal case, showing details of structure, and dorsal view of another cocoon, showing emergence slit and exit-hole of *Rhachioplex.* × 1½.

The following is a description of the external morphology taken from a few pupae of *Rh. javanicus,* the only immature stage that has come to our knowledge so far.

The c o c o o n (fig. 2) is variable in size (from 9-11 mm long, and from 3—3.8 mm broad), about three times longer than wide and evenly rounded at both ends. It is dark reddish brown in colour with slight purplish bronzed reflex, the thin wall consisting of a very tough silken substance. In ventral aspect there is a flattened strip running from pole to pole, with which the cocoon is firmly pressed against the ventral wall of the inner cover of the host's pupal case, both ends of which appear collapsed when no longer containing the chrysalis of *Aulacodes.* Each cocoon of the latter never lodges more than one parasite.

The p u p a (fig. 2), 7.2 cm long in the figured specimen, is pale yellowish brown in colour, the head, pronotum and the abdominal tergites being decidedly

darker, whilst the apical half of the antennae, the legs and the remainder of abdomen are pale yellowish. The head is deflexed upon the prosternum, and the antennae lie along the outer edge of the abdomen. Legs pressed closely to the sides of the body with femora drawn forwards and the tibiae folded back upon them; the posterior tarsi extend to the apex of abdomen. Abdomen fully developed, the lateral tubercles being inconspicuous. First segment rather shorter than second, this longer than third, which is about equal in length to the next two segments. Pygidium well visible, whitish in colour.

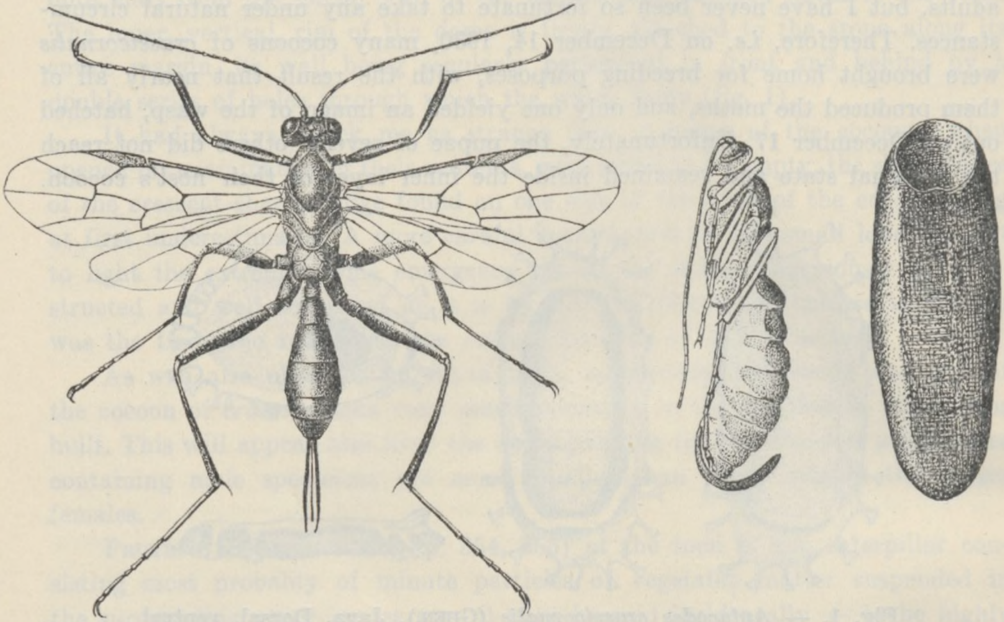

Fig. 2. — *Rhachioplex javanicus* FERRIÈRE. ♀ Java. Adult female (left), left side view of pupa, and ventral aspect of cocoon (right). × 6.

Ovipositor rather long, gradually curved upwards and strongly bent dorsad, the apices of valves reaching to the middle of the sixth abdominal tergite. Valves growing darker towards the end, depressed and lanceolate distally.

Further observations in the field are badly needed, especially with a view to learning the method of oviposition and to find out what are the conditions responsible for the subsistence of the previous larval instars, the latter being still quite unknown.

DIPTERA NEMATOCERA FROM THE DUTCH EAST INDIES.

By

F. W. EDWARDS.

(British Museum, Natural History).

V. NEW AND LITTLE KNOWN SPECIES, CHIEFLY FROM JAVA [1]).

This report deals chiefly with a collection made by Dr. DAMMERMAN on Mt. Idjen, East Java, in 1924, which included a rather surprising number of new species. The study of the present material tends strongly to confirm the idea that the Nematocerous fauna of the mountains of East Java is to a large extent different from that of the rather better-known mountains of West Java, the latter showing much more affinity with the Sumatran fauna.

In addition to the Mt. Idjen collection, some interesting material collected by Mr. LIEFTINCK in West Java is also reported upon here, together with a few other specimens, including two new species found by Dr. DAMMERMAN on Soemba, and some from Sumatra and other small neighbouring islands. Thanks to the continued generosity of the Director of the Buitenzorg Museum, all types are preserved in the British Museum.

MYCETOPHILIDAE.

Macrocera microsticta sp. n.

♀ H e a d dark above, face ochreous. Antennae about three times as long as body; scape ochreous, flagellum dark. Palpi blackish. T h o r a x brownish-ochreous, pleurae mainly brownish, but no distinct markings. A b d o m e n dark brownish, posterior margins of segments rather broadly ochreous, on tergite 2 the dark area reduced to a basal band. L e g s with front and middle coxae ochreous, hind coxae rather dark brownish; remainder of legs light brownish. W i n g s rather densely hairy over most of the surface, with inconspicuous markings consisting of a dark streak in basal cell in line with *Rs*, another dark streak between *R1* and *Rs*, a slight cloud over veins in middle, a small spot in the narrowest part of cell *Cu1* and a very faint cloud at wing-tip towards costa. Tip of *R1* swollen; *R4* very short and transverse; costa much produced; anal area very obtuse. Halteres with dark knob.

Length of body, 3-3.5 mm; wing 4.5-5 mm; antennae 9-12 mm.

E. J a v a: Mt. Idjen, 1850 m, Ongop-Ongop, V. 1924, 2 ♀, (DAMMERMAN).

This is rather nearly related to *M. brunnea* BRUN. (India) differing in the

[1]) Cfr. Treubia Vol.III, p.180; Vol.VI, p.154; Vol.IX, p.352 and 357.

longer antennae and also (if British Museum material is correctly determined) in the dark hind coxae and more hairy wings with more obtuse anal area.

Rondaniella rufiseta sp. n.

H e a d ochreous, with a dark spot over ocelli. Antennae with scape and first two or three flagellar segments ochreous, rest blackish. Palpi yellow. T h o r a x with shoulders extensively ochreous, also anterior part of pleurae; mesonotum with three black stripes which are completely confluent in ♂, separate in ♀; scutellum, postnotum and pleurotergites black. Scutellum with four strong bristles. A b d o m e n blackish, only first two or three segments more brownish in middle. L e g s ochreous; hind femora rather broadly black at tip but not at base. Tibial bristles all pale reddish; only two or three short dorsal bristles on front tibia; middle and hind tibia with bristles in three rows; middle tibia also with one very long ventral bristle. W i n g s yellowish-tinged, with a broad dark brown band close to tip, leaving the extreme tip almost clear. A slight dark shade below *Cu2*. Vein *M1* only very narrowly interrupted at base, bent beyond its middle so that it is parallel with *M2* distally. *Cu1* not quite reaching margin. Halteres yellow.

Length of body, 3-4 mm; wing 3-4 mm.

E. J a v a: Mt. Idjen, 1850 m, Ongop-Ongop, v. 1924, 1 ♂, 1 ♀ (DAMMERMAN).

This is a true *Rondaniella* related to the European *R. dimidiata* MG. from which it differs in the black abdomen, pale tibial bristles, partly clear wing-tip and bent vein *M1*. The other Oriental species of *Rondaniella* known to me belong to the subgenus *Indoleia*.

Leia nigriventris sp.n.

♀ H e a d ochreous, with small dark spots over ocelli; palpi, scape and underside of first three or four flagellar segments ochreous, remainder of flagellum dark brownish. T h o r a x with ochreous ground-colour, uniformly shining; a very large black area above wing root; scutellum pale, but postnotum and pleurotergites wholly black, as well as posterior portion of pleurae. Scutellum with four bristles as usual. A b d o m e n almost wholly black above, tergites 2-4 indistinctly brownish in middle; venter and cerci pale. L e g s ochreous, tips of femora not darkened, but hind femora extensively darkened at base beneath. Bristles black, normal in arrangement; spurs ochreous. W i n g s faintly yellowish, without markings; veins dark; *r-m* considerably longer than *R1*, which is equal in length to stem of fork; *Cu1* only just detached at base. Halteres yellow.

Length of body, 4 mm; wing, 4 mm.

E. J a v a: Mt. Idjen, 1850 m, Ongop-Ongop, v. 1924, 1 ♀ (DAMMERMAN).

This is closely related to *L. arcuata* BRUN. and *L. bimaculata* WALK. of India, but I believe all three are distinct species. In *L. arcuata* the abdomen has large basal lateral yellow areas on each of segments 2-4, and the wings

normally have a brown subapical band; in the damaged type of *L. bimaculata* the antennal flagellum is entirely black (even on under side of first segment) the basal half of the postnotum is yellowish, and the hind femora are not in the least darkened at the base beneath. Other very similar species occur in South Africa and South America.

Mycetophila rudis WINN.

W. Java: Mt. Pangrango, 3000 m, xii.1915, 1 ♂.

The specimen agrees fairly closely with British examples of the species as regards colouring, chaetotaxy and structure of hypopygium; as *M. rudis* is quite a well-defined species the identification appears beyond question, and its capture on Mt. Pangrango affords interesting new evidence of the occurrence of a definite Palaearctic element on the high mountains of Java. The European *Leia winthemi* has already been recorded from that locality.

Mycetophila lineola MG.

W. Java: Mt. Pangrango, 3000 m, vi.1919, 1 ♀ (DOCTERS v. LEEUWEN).

In the absence of the male sex the determination is not quite certain, but no distinctions are apparent from this common European species, which is already known from several parts of the Oriental region as well as from East Africa.

ANISOPODIDAE.

Anisopus glabrifrons sp. n.

♀ Allied to *A. fulvithorax* DE MEIJ. (Sumatra) which it resembles in its uniformly dull orange scutum and wholly black antennae and palpi, and also in wing-markings, differing as follows:— Frons shining in middle, instead of dull dark greyish as in *A. fulvithorax* and most other species of the genus. Palpi somewhat shorter, terminal segment less than three times as long as penultimate. Hind tibiae rather broadly blackish at tip. All tarsi with first two segments ochreous, with tips darkened. Scutellum, postnotum and pleurae distinctly darker than scutum. Wings with the tip more uniformly darkened, but the inner edge of the dark area, adjacent to the pale costal area, more noticeably darker than the remainder, especially below vein $R4 + 5$.

E. Java: Mt. Idjen, 1850 m, Ongop-Ongop, v. 1924, 1 ♀ (DAMMERMAN).

The other Javan species of this group (*A. javanicus* EDW.) is much less closely allied to the new species than is the Sumatran *A. fulvithorax*.

BIBIONIDAE.

Crapitula melanaspis WIED.

A series of males from Garoet, Kamodjang, 1400 m (W. Java), and of females from Mt. Idjen, 1850 m (E. Java), shows that the size and shape of the black mark on the front of the mesonotum is subject to considerable variation, but it is much smaller in the females than in the males, the former

sex rather closely resembling *C. japonica.* The difference in the hypopygium between *C. melanaspis* and *C. japonica,* to which I have previously called attention, appears to be constant, but it remains to be seen whether males from Mt. Idjen agree with those from other parts of Java.

Plecia subvarians WALK.

W. Java: Buitenzorg, 30.ix.22, 1 ♂.

This is the first record of this species from Java; it has already been noted from Borneo, Singapore and Sumatra. In the present specimen the process of the ninth sternite is more expanded apically than usual.

Plecia javensis EDW.

N. W. Soemba: Laora, 100 m, v. 1925 (DAMMERMAN).

The species was previously known only from Java. In Australia and the New Hebrides it is represented by the closely-allied *P. amplipennis* SKUSE, which might have been expected to extend to the eastern Sunda Is., but the hypopygium of the Soemba male agrees rather with *P. javensis* than with *P. amplipennis.*

Plecia morosa sp. n.

♂ Black, including all appendages; only a small area on each side of scutum in front of wing-base and base of stem of halteres reddish-tinged; thorax somewhat shining, without grey pruinescence; abdomen scarcely shining. Ocellar tubercle large. Antennal flagellum with 6 distinct segments; 2-5 equal in size and slightly broader than long; 6 appearing somewhat larger owing to its more or less complete fusion with a small seventh segment. Legs moderately slender except that all the femora are thickened on about the distal half; pubescence short and inconspicuous. Hypopygium with lobes of ninth tergite very long (see figure in Treubia, Vol. ix, p. 363). Wings greyish with darker stigma; *R4* short and subtranverse.

Length of the body, 6 mm; wing, 6 mm.

W. Java: Tjibodas, 1400 m, 1923, 6 ♂ (KARNY).

Five of these specimens were previously recorded by me as *P. tristis* V.D. W., a determination which now proves to be erroneous. At the time when these specimens were noted *P. tristis* was the only black *Plecia* known in Java, and it seemed possible that the difference in thoracic colouring from VAN DER WULP's type might be due to a difference in sex only.

Plecia tristis V.D. W.

E. Java: Mt. Idjen, 1850 m, Ongop-Ongop, v. 1924, 1 ♂ (DAMMERMAN).

In this specimen the thorax is as described by VAN DER WULP, heavily dusted with pale grey on most of the surface, with three practically confluent shining black stripes; the abdomen is distinctly shining black. Antennal flagellum with only four distinct segments, of which the last is only indistinctly divided into three, the terminal division (sixth flagellar segment) very small. Femora less thickened apically than in *P. morosa,* especially the hind pair,

which are quite slender on the basal three fourths; tibiae on the other hand stouter than in *P. morosa*, especially the hind pair, which are distinctly flattened, more so than the front or middle pairs; first hind tarsal segment slightly thickened; pubescence of legs longer and denser than in *P. morosa*. Hypopygium with lobes of tergite large but broad, not produced; sternite large, with very small styles. Wings with *R4* more oblique than in *P. morosa* and quite straight.

The type of *P. tristis* (a female) was also from East Java (Mt. Ardjoeno).

Dilophus obtusus sp. n.

♂ Entirely black, including antennae, legs and halteres; only second antennal segment and base of halteres brownish. Antennae longer and more slender than in most species of the genus; flagellum with 10-11 segments, of which the last 4-5 are only indistinctly separated, though subequal in size to those preceding. Rostrum scarcely produced beyond eyes, which are almost completely bare. Thorax shining, except area in front of scutellum and an area on each side in front of wing-base, which appear dull owing to dense microscopic pubescence; rather numerous longer pale hairs mixed with the pubescence. Each comb with about 10 teeth, those of anteroir comb rather long and pointed; area between and including comb raised above level of rest of thorax. Legs with short pubescence, chiefly on tibiae; front femora moderately thick, hind femora thickened on distal half, hind tibiae and tarsi slender. Front tibia with two spines placed side by side and close together externo-dorsally at middle; two more, also side by side but much wider apart, immediately beyond middle; eight at tip, in addition to the spur; all spines sharp-pointed and rather slender. Wings slightly smoky except at the yellowish base, all veins dark; stigma dark brown and conspicuous. Costa reaching half-way to *M1;* base of *Rs* very oblique, approaching horizontal; cell *M1* just sessile. Anal area not greatly developed, somewhat obtuse.

Length of body, 5 mm; wing, 5 mm.

E. Java: Mt. Idjen, 1850 m. Ongop-Ongop, v. 1924, 1 ♂ (DAMMERMAN).

This resembles *D. trispinosus* EDW. (Philippine Islands) in its rather long antennae and black legs, differing from that and other related species in the obtuse anal area of the wing.

Dilophus sublacteatus sp. n.

♂ Black, with all coxae and femora orange-yellow; second antennal segment and stem of halteres also yellowish. Eyes quite bare. Antennae very short but not very thick, slightly clubbed at tip; flagellum composed of at most eight segments, of which the last four are practically fused. Thorax brightly shining; area between and in front of combs microscopically sculptured; small areas in front of scutellum and wings dull. Each comb with 10-12 teeth, those of anterior comb strong and close-set but pointed; area between combs not raised above level of rest of mesonotum. Legs with very short pubescence. Front femur very little thickened; hind legs rather short, femur slightly thickened on distal half, tibia and tarsus slender. Front tibia with three spines in an

oblique row dorsally before middle; two more externally beyond middle, one well in front of the other; all spines pointed and only moderately stout. Wings clear, slightly milky, without stigma; anterior veins dark brown, posterior veins white. Base of *Rs* short and sub-transverse; cell *M1* just sessile. Anal area large and very acute.

Length of body, 4 mm; wing, 3.5 mm.

W. Java: Tjibodas, 1400 m, 1923, 1 ♂ (KARNY).

This differs from other Oriental species known to me in the completely unclouded and slightly milky wings, without any obvious stigma. It is just possible that it may be the male of the allied *D. nigristigma* DE MEIJ., but this is not very likely. A male of another very similar species with tinted wings and dark veins and stigma was also taken by Dr. KARNY at Tjibodas, and is provisionally referred to *D. nigristigma.*

TIPULIDAE.

Limonia penumbrata sp. n.

♂ Head dark grey; antennae, rostrum and palpi wholly blackish. Front at its narrowest only as wide as one facet. Flagellar segments elongate-oval, with short verticils. Palpi normal, of moderate length. Thorax much humped; ground colour ochreous, middle of praescutum and scutum, also whole of scutellum and postnotum darker; a broad but not sharpely defined dark brown stripe from neck to base of abdomen. Abdomen dark brownish, posterior margins of tergites and sternites narrowly pale; sternite 2 mainly pale. Hypopygium small; tergite somewhat prominent in middle; only one style present, somewhat thickened on proximal half, distal half curved, tapering, pointed, with only one small hair at tip. Legs very slender, brownish, tips of femora narrowly paler. Claws with sub-basal tooth. Wings light greyish with dark stigma and narrow dark seams on cord and base of *Rs. Sc* ending above middle of *Rs.* Halteres blackish, only base of stem pale.

Length of body, 5 mm; wing, 7 mm.

E. Java: Mt. Idjen 1850 m, Ongop-Ongop, v. 1924, 1 ♂ (DAMMERMAN).

This rather closely resembles *L. umbrata* DE MEIJ., differing chiefly in the small, simple hypopygium and colouring of the underside of the abdomen. Several Philippine species, such as *L. pacata* ALEX. have a somewhat similar hypopygium, but differ in antennal structure and other respects.

Limonia (Geranomyia) nitida DE MEIJ.

N. Java: Bawang, Pekalongan, 30.iii. 1927, 3 ♂ (S. L. BRUG).

This species was described from females only from Wonosobo, and so far as I am aware the male has not been recorded. The specimens before me agree well with the description and as they are from the same region are almost certainly correctly named. The hypopygium has the rostral prolongation of the style of rather unusual form; it bears two finger like processes ending in hairs, one hair long, the other short.

Limonia (Geranomyia) linearis ALEX.

W. Java: Tjibodas, 1400 m, ♂ (KARNY). Mt. Megamendoeng, 800 m, 7. vi. 1931, 1 ♀ "on rocks in mid-stream" (LIEFTINCK).

This male specimen agrees with ALEXANDER's description of the type (which was also from Tjibodas) except that the margin of the praescutum is broadly yellowish, quite as in *L.* (*G.*) *nitida;* the hypopygium, however, is quite different from that of *L.* (*G.*) *nitida* and is figured for comparison. The female has only the shoulders distinctly yellowish, as described for the type.

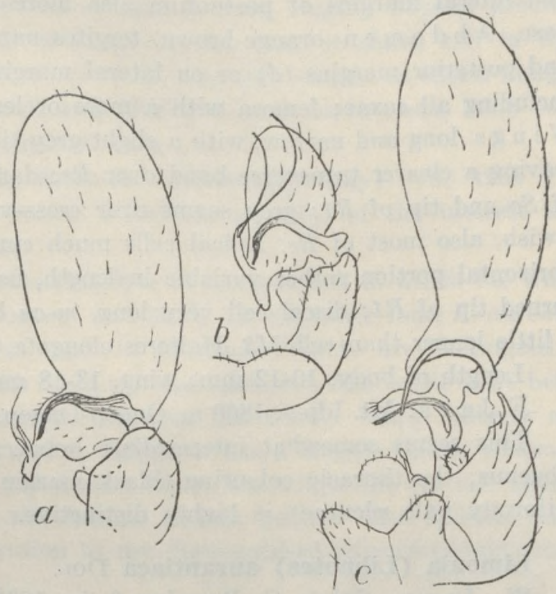

Fig. 1. — Hypopygium of Javan species of *Limonia* (*Geranomyia*). *a*, *L.nitida* DE MEIJ.; *b*, *L. lampronota*, sp.n.; *c*, *L.linearis* ALEX.

Limonia (Geranomyia) lampronota sp. n.

Head blackish above and behind; front rather narrow and heavily dusted with silvery-grey as seen from above. Proboscis much longer than head and thorax together, blackish, including labella and 1-segmented palpi; antennae also blackish, flagellar segments shortly oval. Thorax ochreous, darker dorsally but devoid of markings; mesonotum uniformly and rather brightly shining, without grey dusting on any part. Abdomen dark brownish above, lighter beneath. Hypopygium as figured; fleshy appendage not enlarged; rostrum with two long curved bristles borne on a single finger-like process. Legs brownish; tarsi not paler than tibiae. Wings clear, with small dark brown stigma, and small light brown clouds as follows: before middle of cell *R;* around base and above fork *Rs;* and at tip of *R2-3*. Cord and end of discal cell scarcely clouded. *Sc* ending immediately before fork of *Rs; m-cu* at base of discal cell as usual. Wing-length 6 mm.

W. Java: Tjisaroea, 1500 m, Mt. Gedeh, 19. vi. 1932, type ♂ (LIEFTINCK).

N. Java: Bawang, Pekalongan, 30. iii. 1927, 1 ♀ (S. L. BRUG).

This species is distinguished from other Oriental forms of the subgenus known to me by the combination of slightly spotted wings and uniformly shining mesonotum. The wing-markings are not unlike those of the Malayan *L.* (*G.*) *flavitarsis* EDW.

Limonia (Libnotes) atroguttata sp. n.

Head buff-coloured, including the narrow front; rostrum, first antennal and first palpal segments yellowish, remainder of palpi and antennae black.

Flagellar segments shortly oval, each with one dorsal hair which is not much longer than the segment. T h o r a x almost uniformly dull orange-brown; a velvet-black mark on each side of praescutum extending from pseudo-suture to suture; pleurae rather lighter than dorsum and rather pruinose; lateral margin of praescutum in front of pseudosuture blackened in some specimens, and lateral margins of postnotum also more or less blackened, especially at base. A b d o m e n orange-brown, tergites narrowly blackish-brown on lateral and posterior margins (♂) or on lateral margins only (♀). L e g s light brown, including all coxae; femora with a more or less obvious dark sub-apical ring. W i n g s long and narrow, with a slight grey tinge over most of the membrane, leaving a clearer transverse band over *Rs;* dark grey areas at base of *Rs,* tip of *Sc* and tip of *R1;* grey seams over cross-veins; costa and costal cell yellowish, also most of *Rs.* Apical cells much curved down as usual; *r* bent, its horizontal portion rather variable in length, usually about as long as the upturned tip of *R1;* discal cell very long, *m-cu* before its middle; cell *M1* only a little longer than cell *M3.* Halteres elongate, mostly dark brownish.

Length of body, 10-12 mm; wing, 13-18 mm.

E. J a v a: Mt. Idjen, 1850 m, Ongop-Ongop, v. 1924, 4 ♂ 2 ♀ (DAMMERMAN).

This seems somewhat intermediate between the two main groups of the subgenus; the thoracic colouring (black margin of praescutum combined with uniformly pale pleurae) is highly distinctive.

Limonia (Libnotes) aurantiaca DOL.

W. J a v a: Salak, G. Boender, 6. iv. 1931, 1 ♂ (LIEFTINCK).

This is the first Javan record for this Austro-Malayan species. The specimen before me agrees with one I have recently examined from Borneo in lacking the black tips to the femora.

Limonia (Libnotes) nigricornis ALEX.

W. J a v a: Mt. Megamendoeng, 800 m, 7. vi. 1931, 1 ♂ "on rocks in mid-stream" (LIEFTINCK).

The habitat recorded for this specimen is unusual for a member of this subgenus.

Limonia (Libnotes) soembana sp. n.

♂. Closely related to, and perhaps only a variety of *L. vittata* EDW., with which it agrees in venation and other structural characters, as well as in markings of pleurae and wings, differing chiefly in markings of mesonotum and abdomen, as follows:— Praescutum without darkening at sides anteriorly, but with indications of four dark brown stripes posteriorly. Scutum mainly blackish. Scutellum and postnotum wholly blackish instead of pale ochreous. Abdomen brownish above, with continuous median and lateral blackish stripes. Femora with the dark ring almost apical. Tibiae largely brownish, narrowly pale at base and also with an indefinite pale band just before the tip.

E. S o e m b a: Máo Marroe, 450 m, v. 1925, 1 ♂ (DAMMERMAN).

Limonia (Dapanoptera) carolina sp. n.

♂ Head blackish, but rather heavily dusted with grey; proboscis, palpi and antennal scape black, flagellum yellow as usual in this group. Thorax wholly dull dark reddish brown, almost black. Abdomen wholly black, tergites dull, sternites mostly brightly shining except on their posterior margins. Legs wholly black. Wings black at base to very slightly beyond arculus, then broadly orange, distal half or nearly (from base of discal cell to tip) black; the usual pure white spot at tip of *R1*, this spot situate on costal margin almost in the middle of the black area. Halteres with black stem, knob conspicuously pale yellow. Wing-length 13 mm.

North New Guinea: Hollandia (Humboldt Bay), vii. 1931 (W. STÜBER). The specimen seems worth describing in view of the interest and rarity of species of *Dapanoptera*.

This is the fifth species of the subgenus to be described in which the wings are conspicuously banded with orange and black. Of the other four, *L. auroatra* WALK., *L. fascipennis* DE MEIJ. and *L. latifascia* WALK. are distinguished by having the black area at the wing-tip less extensive, the white spot being on its inner margin; in addition *L. auroatra* has wholly black halteres and more broadly black wing-base, and *L. latifascia* has a largely yellow abdomen. The remaining species, *L.* (*D.*) *pulchra* DE MEIJ., has wings like the new species but has the thorax grey and the femora largely yellow. The specific name *carolina* is intended as a dedication to my distinguished co-worker and friend Dr. CHARLES P. ALEXANDER.

It may here be noted that a specimen of *L.* (*D.*) *auroatra* labelled "Mano kwari (New Guinea)" has recently been received at the British Museum.

Styringomyia didyma GRIMSHAW.

Riouw Archipelago: Doerian Is., xi. 1923, 1 ♂ (DAMMERMAN).

The occurrence of this Polynesian species so far west is surprising, the most westerly record previously known to me being the island of Yap. There is however no doubt of the identification, the characteristic hypopygium being quite typical.

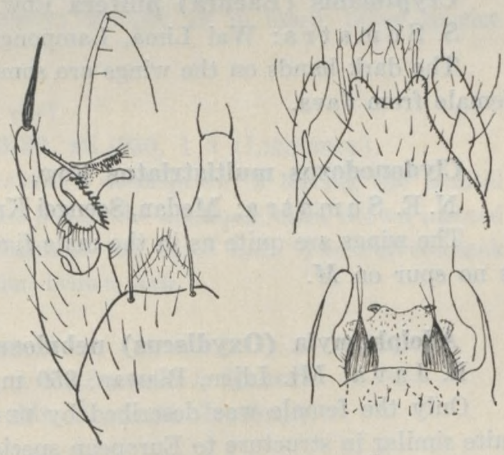

Fig. 2. — *Styringomyia soembana*, sp.n. ♂ and ♀ genitalia.

Styringomyia soembana sp. n.

Head yellowish, with the main bristles black and slightly flattened. Antennae and palpi mainly pale. Thorax yellowish, with scarcely a trace of dark markings dorsally; upper half of pleurae somewhat brownish, lower half pale yellow. Main bristles of praescutum and scutum black and somewhat flattened, but not conspicuously

bladelike. Abdomen brownish-ochreous with a rather broad but indefinite median longitudinal darker stripe; posterior margins of tergites narrowly dark brown, but the dark colour not forming double spots. Legs yellowish, with the usual dark rings, which are fairly distinct and complete. Wings with slight blackening over *r-m* and at tip of discal cell; tip of *Ax* curved to margin and slightly darkened. Genitalia of both sexes as figured; tip of ninth sternite in ♂ neither blackened nor pubescent; ninth tergite with a pair of unusually strong bristles.

N. E. Soemba: Kambera, iii.1925, 1 ♂, 1 ♀ (DAMMERMAN).

S. soembana belongs to a group of closely related forms which includes *S. javana* EDW., *S. formosana* EDW., *S. papuana* EDW., *S. borneana* EDW., and a number of others, from all of which it differs in details of the structure of the hypopygium. Its closest ally is perhaps *S. nigrosternata* ALEX. (Mindanao) which is similar in most respects but has the tip of the ninth sternite of the ♂ blackened and pubescent.

Molophilus bicolor DE MEIJ.

E. Java: Mt. Idjen, 1850 m, Ongop-Ongop, 1 ♂ (DAMMERMAN).

This was described from the female only; the identification of the male is therefore a matter of conjecture. In the present specimen the antennae are short, like those of the female; the hypopygium has only one pair of styles, which are about twice as long as the coxite and curved, the basal half slender and pale, distal half black, with serrulate margins; at the base of the black portion the style is widened, with a short thick branch on each side.

Cryptolabis (Baeura) pilifera EDW.

S. Sumatra: Wai Lima, Lampongs, xi.1921, 1 ♂ (KARNY).

The dark bands on the wings are somewhat more distinct than in the type female from Java.

Clydonodozus multistriatus EDW.

N. E. Sumatra: Medan, Soengei Krio. iv.1928, 1 ♀ (J. C. v.D. MEER MOHR).

The wings are quite as in the male figured by ENDERLEIN, except that there is no spur on *M*.

Adelphomyia (Oxydiscus) nebulosus DE MEIJ.

E. Java: Mt. Idjen, Blawan, 950 m, 1 ♂ (DAMMERMAN).

Only the female was described by DE MEIJERE. The male hypopygium is quite similar in structure to European species of *Adelphomyia*, and ALEXANDER's action in sinking *Oxydiscus* under *Adelphomyia* is thus confirmed.

Eriocera albiprivata sp. n.

Head black, including scape and palpi; front with slight greyish dusting; flagellum yellowish except towards tip. Antennae short. Thorax wholly velvet

black, almost bare. A b d o m e n with segment 1 velvet-black; 2-5 mainly dull orange-yellow, with posterior margins of tergites and sternites and lateral margins of tergites narrowly black, tergites also with a median black line expanding posteriorly into a small triangle; 6 black with a pair of orange patches at base; 7-9 black. L e g s with coxae and trochanters black; femora and tibiae yellowish brown with black tips, tarsi darkened. W i n g s uniformly blackish, unmarked even at extreme tip. Venation much as in *E. albipuncta* V.D. W.; cell *M1* absent and *Sc* ending above or slightly beyond *r*. Halteres blackish.

Length of body 17-21 mm; wing 12-15 mm.

M i d J a v a: Karimon Djawa Islands (Java Sea), 22-30. xi.1930, 3 ♂ 1 ♀ (LIEFTINCK).

This is possibly a variety of *E. albipuncta* V.D. W., from which it differs not only in the absence of the white spot at the wing-tip but also in the presence of a mid-dorsal black stripe on the abdomen, somewhat as in *E. acrostacta* WIED.

Eriocera paenulata END.

E. J a v a: Mt. Idjen, 950 m, Blawan, vi.1924, 1 ♂ 1 ♀ (DAMMERMAN).

The specimens agree rather closely with a male in the British Museum from Sumatra.

Eriocera acrostacta WIED.

W. J a v a: Mt. Gedeh, Tjibodas and Telagawarna, 1400 m, 6 ♂ 1 ♀ (LIEFTINCK).

The series shows considerable variation in the size of the sub-basal white mark of the wing, but the apical white dot is always present. The venation is also somewhat variable, but *r* is always oblique, as in many other species of this group.

Eriocera lamonganensis ALEX., var?

W, J a v a: Tjibodas, 1400 m, 23-30. xii.1930, 1 ♀ (LIEFTINCK).

This specimen differs from ALEXANDER's description in having the frontal tubercle very definitely double, segments 8-9 of the abdomen dark brown instead of orange, and the femora yellow on almost the basal half. The velvet-black mesonotum is clothed with short golden-brown hair.

Eriocera pyrrhomesa EDW.

W. S u m a t r a: Sibolga, x.1925, 1 ♂ (FULMEK & KARNY).

Agrees well with the type from Mt. Korinchi (Korintji).

Eriocera flavitarsis EDW.

N. E. S u m a t r a: Habinsaran, Simanimbo, 1.viii.28, 1 ♀ (J. C. V.D. MEER MOHR).

This is the first record of the occurrence of this very distinct species outside the Malay Peninsula.

Eriocera basilaris WIED.

W. Java: Tjibodas and Garoet, Kamodjang, 1400 m, 3 ♀ (LIEFTINCK).

E. Java: Blawan, Mt. Idjen, 950 m, 1 broken specimen (DAMMERMAN).

The Mt. Idjen specimen has the bases of the wings and femora black instead of yellow, but seems to be conspecific; the others show notable variation in the size of the subapical crescent of the wing.

Ctenacroscelis castaneus (MACQ.).

W. Java: G. Karang, 27.v.1931, 800 m, 2 ♂ (LIEFTINCK).

This species has been wrongly treated as synonymous with *C. umbrinus* W. I think there can be no doubt of the identity of the specimens before me as they agree with MACQUART's description in having no pale mark on the wing before the stigma and the hypopygium mainly yellowish, both points of difference from *C. umbrinus;* other distinctions from *C. umbrinus* are that the flagellar segments are much less enlarged beneath, and that a blackened dot is present above the root of each antenna. In the latter feature *C. castaneus* agrees with *C. punctifrons* ROND. of Borneo, which should probably be regarded as a race of *C. castaneus,* although there are some slight differences, a male in the British Museum from North Borneo having the outer style more emarginate on the distal margin.

Ctenacroscelis praepotens WIED.

W. Java: Tjisaroea, Mt. Gedeh, 1,000 m, 5.vi.1932, 1 ♂ (LIEFTINCK); Soekaboemi, 2 ♀ (through E. LE MOULT); Garoet, Kamodjang, 1400 m, v.1929, 1 ♀.

As I have pointed out elsewhere, this species is almost certainly confined to Java, various old records from other countries being based on misidentifications.

The male of *praepotens* has not hitherto been described. It has a hypopygium of the type usual in this genus, but with one striking peculiarity: the ninth sternite has a short but conspicuous median projection which is densely covered with short black hairs.

The female specimen from Garoet shows the distinctive colouring of the wings described by WIEDEMANN, the large stigma being pale yellow and contrasting strongly with the general brownish-ochreous ground-colour; the thoracic markings are very faint and ill-defined. Two structural peculiarities are worth noting: the nasus is rudimentary and the vein *M4* is strongly curved upwards at the tip.

Ctenacroscelis dammermani sp. n.

Head bright ochreous or orange, including the whole rostrum. No trace of nasus. Antennae with scape bright ochreous, flagellum wholly black, of moderate length, without verticils; segments 6-10 slightly rounded beneath. Palpi blackish. Thorax with ground-colour bright ochreous, including pronotum, scutellum, postnotum and whole of pleurae; praescutum with three

and scutum with two rather sharply-defined and narrowly separated black or dark brown stripes; median stripe usually entire but in one or two specimens more or less divided by a median pale line. Some long erect pale hair on mesonotum and on parts of pleurae, most noticeable on shoulders, scutellum and postnotum. A b d o m e n with segments 1-4 in both sexes uniformly ochreous, without a trace of dark stripes; 5-8, also base of hypopygium of ♂, blackish. Hypopygium of normal structure; lobes of tergite pale, shortly hairy, squarely truncate; outer style not very broad, but broader and more tapering than in ALEXANDER's figure of *C. monochrous;* inner style hairy on basal half. L e g s light to dark brownish, tips of femora and tibiae more or less darkened. W i n g s pale greyish with darker veins; the only marking being the small dark grey stigma. Costal cell somewhat yellowish. Halteres with knob darkened except at tip.

Length of body, 25 mm (♂)-40 mm (♀); wing 24-30 mm.

E. J a v a: Mt. Idjen; Blawan, 950 m, v.1924, 2 ♂, 3 ♀; Kendeng, 1400 m, vi.1924, 3 ♀ (DAMMERMAN).

This species belongs to a small group which differs from other groups of the genus by the complete absence of a nasus, uniformly ochreous rostrum and pleurae, absence of all wing-markings except the stigma, even *m-cu* having no trace of any dark seam. To this group belong *C. monochrous* WIED., *C. pilosulus* V.D. W., *C. flavus* BRUN., *C. ornatithorax* BRUN., and probably *C. rex* ALEX. The present form is evidently closely allied to *C. monochrous* WIED., and may be merely a variety of that species, but according to WIEDEMANN the first and following abdominal tergites in his type show indications of two dark stripes (such, presumably, as may be seen in *C. ornatithorax* BRUN.), and the antennal flagellum is only gradually darkened towards the tip; moreover it is difficult to reconcile WIEDEMANN's description of the "After" with either sex of the present species.

In one female the abdomen is practically unicolorous, segments 5-8 being darker than the remainder.

Ctenacroscelis andrewsi sp. n.

Closely allied to *C. umbrinus* WIED., differing as follows:— Size rather smaller. Antennae (♂) shorter and rather stouter, with shorter hairs; flagellar segments only very slightly rounded beneath. Praescutum with four brown stripes in addition to the dark margin, the stripes not darkened on their inner margins and distinctly separate, the yellowish line dividing the middle pair running the whole length. Dark transverse marks on coxae less distinct than is usual in *C. umbrinus*. Abdomen more mottled. Hypopygium, legs and wings much as in *C. umbrinus;* lobes of ninth tergite less densely pubescent, less square-ended and separated by a wider notch.

Length of body, 14 mm; wing, 18 mm.

C h r i s t m a s I s l a n d (s. of Java), E. Coast, ix.1897, 1 ♂ (C. W. ANDREWS).

Ctenacroscelis lieftincki sp. n.

Belongs to the group of *C. umbrinus* WIED., which it resembles in size and general appearance, and in having a dark pleural stripe extending from neck to base of halteres, most conspicuous when viewed obliquely from above. Differs from *C. umbrinus* as follows:— Antennae of ♂ with flagellar segments only slightly rounded beneath. Thorax darker, blackish-brown dorsally. Abdomen rather stouter; the hypopygium much larger, only basal part of tergite dark, remainder of hypopygium rather bright orange-brown, contrasting with the black seventh and eighth segments. Legs of ♂ much darker, the femora mainly brown, with a distinct yellowish ring before the broadly black tip, tibiae rather narrowly pale at base only. (Legs of the ♀ before me not much darker than in *C. umbrinus,* the femora largely pale, and without paler preapical ring; the specimen is perhaps immature). Wings rather darker than in *C. umbrinus,* with a rather more conspicuous dark cloud over *M-cu* and a more obvious pale obliterative streak before stigma, also with a small pale mark beyond stigma on tip of *R1,* which is lacking in *C. umbrinus.*

Length of body, 17 mm, (♂)-25 mm, (♀); wing 21-25 mm.

W. Java: Telagawarna, Mt. Gedeh, 1480 m, 1.iii.31, type (LIEFTINCK); Tjibodas, Mt. Gedeh, 27-29 vii.1930, 1 ♂ 1 ♀ (LIEFTINCK).

In the colouring of the legs of the male this species resembles *C. fijiensis* ALEX., which is much smaller and differs in other respects.

Tipula papandajanica sp. n.

♂. Resembles *T. gedehana* DE MEIJ., differing chiefly as follows:— Antennae somewhat longer, slightly exceeding combined length of head and thorax. Wings with the marmorate pattern rather less distinct; lighter areas with a less obvious yellow tinge; dark area over base of *Rs* smaller; clear area towards outer end of cell *M* larger, sub-quadrate; clear area near base of cell *An* also larger and not $<$-shaped as it is in *T. gedehana.* Hypopygium: ninth tergite ochreous, with much soft pale hair, and with broad V-shaped posterior emargination; eighth sternite with small tuft of long yellow hair apically; ninth sternite with about six very long and very stout yellow hairs on each side at base; outer style forked, basal part rather wide but both branches slender, hairy and without any blackening on margins, upper branch longer, lower branch more pointed.

Length of body, 10 mm; wing 15 mm.

W. Java: Mt. Papandajan, Preanger Regency, 6,000 - 7,000 ft., 23. iv. 1923, 1 ♂ (H. M. PENDLEBURY).

The only other *Tipula* with marmorate wings hitherto recorded from Java is *T. gedehana* DE MEIJ., but it is probable that many such species occur. In *T. gedehana* as figured by ALEXANDER and as shown by male specimens collected by Mr. LIEFTINCK at Tjibodas, the hypopygium has a large brush of matted yellow hair at the base beneath and the outer style is simple and fingerlike. The forked outer style of *T. papandajanica* is a peculiar feature seldom

seen in this group of the genus, though a somewhat similar structure is found in the Himalayan *T. reposita* WALK., which is perhaps the nearest ally of the new species.

Tipula sunda ALEX.

W. Java: Mt. Gedeh, viii.1931, Tjibodas, 1,400 m, 1 ♂; Lebak Saät, 2,700-2,800 m, 1 ♂ 1 ♀ (LIEFTINCK).

ALEXANDER described only the male, and omitted to notice the slightly darkened wing-tip and the slight dark cloud over the base of *Rs*. The female has those dark shades more pronounced, and has also a distinct clear area adjacent to *Cu* beyond middle of cell *M*, which is absent or barely perceptible in the male. Ovipositor normal. Antennal flagellum entirely black in both sexes.

T. sunda has much in common with the European *T. hortulana* MG. and is probably to be regarded as belonging to the same group.

Nephrotoma medipubera sp. n.

♀. Head yellow, with a very small blackish spot on occiput and a slightly larger but ill-defined blackish patch adjoining each eye, the three patches quite separate; rostrum with the usual dark marks above and at sides. Antennae with scape yellow, flagellum black. Palpi dark, last segment lighter. Thorax yellow; the usual three black praescutal stripes separate, without dull borders. but lateral stripes with the usual dull blackish area below and adjoining their anterior ends; scutellum and postnotum dull yellow; pleurae yellow, unmarked except that sides of pronotum are blackened and whole of upper division of pleurotergite is also balck. Postnotum (mediotergite) densely covered with very short hair which is directed somewhat forwards and is absent only from the slightly darkened median posterior portion. Abdomen with tergite 1 largely yellowish, with a transverse blackish band near base, connected with other dark marks; 2 with a median longitudinal black area on basal half, connected with a wider black mark on distal half which widens considerably on posterior margin; 3-5 with large black areas which are somewhat widened on posterior margin but do not quite reach anterior margin of tergites and leave sides extensively yellow (except distally); 6 and 7 almost all black; 8 yellowish; sternites 1 - 5 yellowish. No black lateral line on tergites 1 - 5. Legs brownish, tarsi darker; front femora more or less darkened on middle half; all coxae yellowish. Wings faintly tinged, without darkening over cord or at tip; stigma moderately dark brown, with very few hairs. Discal cell moderately large, narrow; cell *M1* just sessile. Halteres yellowish, knob scarcely darkened.

Length of body, 15 mm; wing, 13 mm.

E. Java: Mt. Idjen, 950 m, Blawan, vi. 1924, 2 ♀ (DAMMERMAN).

The most striking feature of this species is the presence of dense, short pubescence over nearly the whole of the postnotal mediotergite; in most other species of the genus, including *N. javensis* and related species with banded

abdomen, this pubescence is either absent or much sparser. The markings of the head and abdomen are also distinct from those of the other Javan species.

Nephrotoma sundaica sp. n.

♀. Similar to *N. medipubera*, differing as follows:— Head with the occipital mark larger, dark patches adjoining eyes smaller, but connected with occipital mark by transverse dark shades. Scutellum shining, largely dark brown in middle. Postnotum with the pubescence confined to the posterior lateral corners. Pleurae with a small dark brown spot immediately below wing-root. Upper division of pleurotergite lighter anteriorly, not wholly black; posterior third of postnotum more distinctly darkened. Abdomen with tergite 1 wholly blackish; 2 with a rather narrow transverse dark band on basal half, distal half almost wholly black. Front femora not darkened in middle. Wings with tip slightly but distinctly darkened; discal cell shorter and smaller; cell *M1* shortly stalked.

♂. Resembles ♀ in colouring. Antennae about as long as head and thorax together; first few flagellar segments with slight basal and apical enlargements beneath. Hypopygium mainly yellowish (except tergite); eighth sternite with some long yellow hair but without tufts or obvious appendage; outer style rather small, yellow, much narrowed on distal third.

Length of body, 10 - 16 mm; wing, 11 - 14 mm.

E. Java: Blawan, Mt. Idjen, 950 m, vi. 1924, 1 ♂ 1 ♀ (DAMMERMAN).

Differs from its allies in abdominal markings, especially the presence of two black bands on the second tergite. *N. javensis* DOL. (Java, Sumatra, Ceylon, India) and *N. fuscapex* EDW. (Malaya) are rather similar and also have a shining, blackish scutellum, but both differ in having extensive black markings on the pleurae; *N. javensis* has no darkening of the wing-tip and *N. fuscapex* has the lower instead of the upper division of the pleurotergite black. *N. sundaica* is more nearly allied to the European *N. flavipalpis* MG. than to any previously described Oriental species, but differs in various details.

A male and female from Soemba I. (Kananggar 700 m, v.1925: DAMMERMAN) appear conspecific with the types from Mt. Idjen, although they differ in some details, notably in having a large blackish spot in the middle of the pleurae.

CADURCIA LEEFMANSI, EINE NEUE ORIENTALISCHE RAUPENFLIEGE

(Dipt. Tach.)

Von

N. BARANOFF

CORRIGENDUM.

Unterschrift der Taf. XVIII, Vol. XII (1930) zu lesen:

Oben: *Atopodon meermohri* nov. spec.

Mitte: *A. amblyops* FOR.

Unten: *A. meermohri, A. amblyops, A. meermohri.*

Ozellarborsten lang, nach vorn gerichtet. Frontoorbitalborsten steigen bis aufs Niveau der Fühlerborste herab. Fühler schwarz und lang, drittes Glied viermal so lang wie das zweite. Vibrissen genau am Mundrande. Facialien nur mit einigen Börstchen dicht ober den Vibrissen. Fühlerborste lang, nur an der Basis verdickt. Zweites Fühlerborstenglied ebenso lang als breit. Taster schwarz, stark verbreitert. Wangen und Backen sehr schmal. Stirn an der Fühlerwurzel kaum vorspringend. Stirnprofil länger als das Gesichtsprofil, in oberer Hälfte deutlich gewölbt. Wangen und Backen grau silberig bereift, erstere nackt, letztere mit wenigen schwarzen Borsten. Hinterkopf unten sehr spärlich, dunkel behaart. Augen nackt. Thorax schwarz, nur schräg von hinten gesehen am Vorderrande mit weissem Reif und mit Spuren von vier schwarzen Längsstriemen. Thorakalbeborstung vollständig. Drei gut entwickelte Sternopleuralborsten. Schildchen länglich, schwarz, mit einer Spur von Rot auf der Spitze, mit drei Seitenborsten und sehr feinen, ungekreuzten Apikalborsten. Die Angularborsten sind am längsten. Abdomen

glänzend schwarz, auf den letzten drei Segmenten mit einer Spur von weissen schmalen Basalbinden, welche an den Seiten deutlicher sind. [1 +] 2.Segment ohne mittlere Randborsten, zuweilen mit einem Paar. 3.Segment mit einem Paar, 4. mit einer Reihe von 8 Borsten. 5. Segment apikal beborstet. Flügel etwas getrübt, mit schwarzen Adern. Erste Hinterrandzelle nahe der Flügelspitze offen. Dritte Längsader mit 2 Börstchen an der Basis. Beugung stumpfwinkelig, ohne Anhang oder Faltenzinke. Hintere Querader deutlich näher der Beugung als der kleinen Querader. Beine schwarz, mit langen Klauen und Pulvillen. H.-Schienen aussen vorn in der Basalhälfte mit einer Reihe von ca 7 ungleichstarken Borsten, in der Mitte mit einer starken Zwischenborste und im apikalen Teil mit 5-6 gleichlangen feinen Börstchen. M.-Schienen innen ohne mittlere Borste, aussen vorn und aussen hinten mit je einer. Viertes Abdominalsegment ohne *Sturmia*-Fleck. Körperlänge 5 1/2 mm.

♀ Stirnbreite am Scheitel beträgt 2/3 der Augenbreite. Stirnstrieme etwas schmäler als die Orbite. Aussere Vertikalborsten vorhanden. Zwei proklinate Orbitalborsten. Thorax und Schildchen wie beim Männchen. Abdomen mit deutlicheren und breiten Basalbinden auf dem 3.-5.Segment; die Binde auf dem 4.Segment ist am breitesten, jedoch kaum breiter als ein Drittel der Segmentlänge. 2. und 3.Tergit mit je einem Paar mittlerer Randborsten. Borstenreihe auf dem hinteren Rande des 4.Tergites wie beim Männchen, dagegen fehlen die Borsten im apikalen Teil des 5.Tergites. H.-Schienen spärlich und ungleich lang beborstet. Klauen und Pulvillen kurz. Körperlänge 5 mm.

Hypopygium von *Cadurcia leefmansi*, n. sp. ♂

Protograph und 2 Cotypen in der Sammlung des „Instituut voor Plantenziekten" in Buitenzorg. 2 Cotypen sowie das Präparat des männlichen Hypopygiums des Protographs bleiben in meiner Sammlung.

ON A SMALL COLLECTION OF BIRDS FROM THE KARIMATA ISLANDS, WEST BORNEO.

By

F. N. CHASEN and C. BODEN KLOSS

(Raffles Museum, Singapore).

The Karimata Islands are a group of small islands and islets lying off the west coast of Borneo. Dr. W. L. ABBOTT collected birds in the group in 1904 and 1908 and the ten species obtained by him were discussed by Dr. H. C. OBERHOLSER in Proc. U. S. National Mus., 64, 1924, Art. 22, pp. 1 - 4.

This short paper seems to have represented our total knowledge of the Karimata avifauna until Mr. L. COOMANS DE RUITER in collaboration with the Zoological Museum at Buitenzorg collected in the islands for ten days at the end of March 1931. Our thanks are due to Dr. K. W. DAMMERMAN for the opportunity of studying the collection. In a number of cases we have had the advantage of comparing the Karimata birds with examples from the adjacent coast of Borneo listed by us in a previous paper (antea pp. 11 - 18).

Specimens were obtained on the following islands.

Panebangan (Panembangan) only ten miles from Poeloe Maja which may be considered as forming part of the mainland of Borneo as it is only insulated by the Maja River (19-20th, 28th March).

Pelapis (Pelapi) one of the islands of a small group southwest of Panembangan (20-21 st March).

Boeroeng (Burong) an islet juist south of Panebangan and between it and the coast of Borneo (22 nd March).

Goeroeng Besar (Gurong) about 7 miles southeast of Pelapis (24 th March).

Karimata Besar (Karimata Islands; Carimata) about 30 miles from the nearest point of the mainland (Maja). This is much the largest island of the group: it meausures approximately 11 by 7 miles (23 rd, 25-26 th March).

Oema and *Poloebang (Peloebang;* Vogelnest Islands) are islets east and slightly south of Karimata Besar and between it and Borneo (26-27 th March).

Seroetoe (Serutu) is a few miles southwest of Karimata Besar (24-25 th March) [1]).

Panebangan and Boeroeng are within the 5 fathom line: the 10 fathom line embraces the Pelapis Islands. Between the latter and Karimata Island 25 fathoms is recorded. It is noteworthy that in the narrow strait, about four miles across, between Karimata and Seroetoe there is a depth of 23 fathoms. MILLER has noticed differences in the mammal fauna of these two islands [2]). Excluding the „deep" between Karimata and Seroetoe all the islands discussed in the present paper can be included within a 15 fathom line.

Between Seroetoe and Billiton there is a deeper channel with soundings of 29 fathoms.

The present collection increases the number of birds known from the islands from 10 to 32. Most of the forms are widely spread in Malaysia and throw no light on the faunal affinities of the Karimata group.

Although the mammals of Karimata Island include an indigenous form of *Pygathrix rubicundus,* a monkey otherwise only found in Borneo, the two species of birds available for critical comparison indicate that the avifauna shows a closer relationship to that of Sumatra than to that of Borneo. The Karimata form of *Kittacincla malabarica* is not *suavis* of the west Bornean lowlands but seems inseparable from *K. m. tricolor* of Sumatra and West Java (we have not seen *abbotti* OBERH. of Banka Island and Billiton). We have also placed the Karimata *Dicaeum trigonostigma* with the subspecies found in Sumatra.

Two species found in the Karimata Islands tend to large size without changing appreciably in colour: a similar change is evident in the same species in other island groups in the south China Sea, the Anamba, Natuna and Tambelan Islands. The species are *Psittacula longicauda* and *Aplonis panayensis:* on a larger series *Pycnonotus brunneus* could perhaps be added.

Within the Karimata group two species, *Cyornis rufigastra* and *Hypothymis azurea,* are represented by subspecies not yet with certainty known from elsewhere and one of the most interesting ornithological features of the islands is that these quite well marked races are found on Panebangan Island which lies within the five fathom line and presumably within sight of the coast of Borneo.

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[1]) Some topographical notes on the Karimata Islands are given by W. L. ABBOTT in Lyon, Proc. U. S. Nat. Mus., 40, 1911, pp. 59, 60: the position of the group is indicated in KLOSS' sketch map of the islands between Sumatra and Borneo, antea XIII, 1931, p. 293.

[2]) Proc. U. S. Nat. Mus., XXXI, 1906, pp. 55-66.

A List of Birds known from the Karimata Islands.

	Panebangan	Pelapis	Boeroeng	Goeroeng	Karimata	Oema	Poloebang	Seroetoe
TRERONIDAE.								
Ducula aenea aenea (LINN.).	✗							
Myristicivora bicolor bicolor (SCOP.).			✗					
COLUMBIDAE.								
Columba argentina (BP.).				✗				
LARIDAE.								
Sterna sumatrana sumatrana RAFFLES.					✗			
CHARADRIIDAE.								
Tringa hypoleucos LINN.	✗							
Charadrius apricarius fulvus GMEL.					✗			
ARDEIDAE.								
Demiegretta sacra sacra (GM.).					✗			
FREGATIDAE.								
Fregata ariel ariel (GOULD).						✗		
AQUILIDAE.								
Cuncuma leucogaster (GM.).					✗			
PSITTACIDAE.								
Psittacula longicauda subsp.					✗			
ALCEDINIDAE.								
Halcyon chloris cyanescens (OBERH.).			✗		✗	✗	✗	
Alcedo atthis bengalensis GMEL.	✗				✗			
MEROPIDAE.								
Merops viridis viridis LINN.								✗

	Panebangan	Pelapis	Boeroeng	Goeroeng	Karimata	Oema	Poloebang	Seroetoe
MICROPODIDAE.								
Hemiprocne longipennis harterti STRES.					×			
CUCULIDAE.								
Hierococcyx fugax fugax (HORSF.).					×			×
Eudynamis scolopacea malayana CAB. & HEINE.						×		
HIRUNDIDAE.								
Hirundo javanica abbotti (OBERH.).	×							
MUSCICAPIDAE.								
Musitrea grisola butaloides STRES.								×
Rhinomyias umbratilis umbratilis (STRICKL.).					×			
Cyornis rufigastra karimatensis OBERH.	×	×			×			×
Hypothymis azurea karimatensis CHAS. & KLOSS.	×	×			×			×
PYCNONOTIDAE.								
Pycnonotus brunneus brunneus MOORE.	×	×						
TURDIDAE.								
Kittacincla malabarica tricolor (VIEILL.).					×			×
STURNIDAE.								
Gracula javana javana (CUV.).	×				×			×
Aplonis panayensis heterochlorus (OBERH.).	×				×			
NECTARINIIDAE.								
Chalcostetha calcostetha calcostetha (JARD.).					×			
Anthreptes malacensis malacensis (SCOP.).	×	×			×			×
Aethopyga siparaja siparaja (RAFFLES).	×				×			×
Leptocoma jugularis pectoralis (HORSF.).	×	×	×		×	×		

	Panebangan	Palapis	Boeroeng	Goeroeng	Karimata	Oema	Poloebang	Seroetoe
DICAEIDAE.								
Dicaeum cruentatum subsp.	×	×			×			
Dicaeum trigonostigma trigonostigma (SCOP.).					×			×
ZOSTEROPIDAE.								
Zosterops chloris maxi FINSCH.			×					

TRERONIDAE.

Ducula aenea aenea (LINN.).
Panebangan, 1 ex.
Wing, about 250 mm.
A large bird but we have a similar specimen from Sarawak.

Myristicivora bicolor bicolor (SCOP.).
Boeroeng, 2 ♂.
Wings, 233, 235 mm.

COLUMBIDAE.

Columba argentina BP.
Goeroeng Besar, 1 ♂, 1 ♀.
Wings, ♂ 245; ♀ 235 mm. „Iris red."

CHARADRIIDAE.

Tringa hypoleucos LINN.
Panebangan, 1 ♂, 1 ♀.
Wing, ♂ 111 mm.

ARDEIDAE.

Demiegretta sacra sacra (GM.).
Karimata Besar, 1 ♂.
In the dark phase.

FREGATIDAE.

Fregata ariel ariel (GOULD).
Oema („birds' nest island"), 1 ♂.

PSITTACIDAE.

Psittacula longicauda subsp.
Karimata Besar, 1 ♂.
Wing, 159 mm.
A large bird suggesting that the Karimata race may belong to the undescribed long-winged form occurring in the Natuna Islands and on Bintang Island in the Rhio Archipelago.

ALCEDINIDAE.

Halcyon chloris cyanescens (OBERH.).
Sauropatis chloris cyanescens, OBERH, p. 2.
Boeroeng, 2 ♀; Oema („birds' nest island") 1 ♀; Poloebang („birds' nest island") 1 ♀.
Wings, 114, 117, 112, 114 mm.

Alcedo atthis bengalensis GMEL.
Alcedo ispida bengalensis, OBERH., p. 2.
Panebangan, 1 ♀.
Wing, 72 mm.

MEROPIDAE.

Merops viridis viridis LINN.
Seroetoe, 1 ♂.
Wing, 109 mm.

MICROPODIDAE.

Hemiprocne longipennis harterti STRES.
Karimata Besar, 1 ♂, 2 ♀.
Wings, ♂ 158 (c.); ♀ 162, 159 mm.

CUCULIDAE.

Hierococcyx fugax fugax (HORSF.).
Hierococcyx fugax fugax, OBERH., p. 2.
Seroetoe, 1 ♀.
Wing, 172 mm.

Eudynamis scolopacea malayana CAB. & HEINE.
Oema („birds' nest island"), 1 ♂.

HIRUNDINIDAE.

Hirundo javanica abbotti (OBERH.).
Panebangan, 2 imm. ex.

MUSCICAPIDAE.

Muscitrea grisola butaloides STRES.

Muscitrea grisola secedens, OBERH., p. 3.

Seroetoe, 2 ♂, 1 ♀.

Wings, ♂ 83, 84 mm.

Rhinomyias umbratilis umbratilis (STRICKL.).

Karimata Besar, 1 ♀.

Wing, 76 mm.

Cyornis rufigastra karimatensis OBERH.

Cyornis banyumas karimatensis OBERH., p. 3: Karimata Island.

Panebangan, Pelapis, Seroetoe, 9 ♂, 5 ♀.,

Wings, ♂ 77.5, 78, 74, 76.5, 78, 75, 77, 77, 77; ♀ 72.5, 74, 71, 74, 71 mm.

C. r. karimatensis is a well marked race. Compared with *C. r. rufigastra* from Borneo it is distinctly larger: on the upperparts the two races are much alike both showing a certain amount of variation in the depth of the blue colour but on the underparts both sexes of *karimatensis* are of a darker, deeper tawny. The undertail coverts are always largely or completely tawny and only the middle line of the abdomen is sometimes whitish. Some males show a well-marked bluish wash on the sides of the breast and flanks, a feature never more than faintly indicated in *C. r. rufigastra*.

Hypothymis azurea karimatensis CHAS. & KLOSS [1]).

Like *H. a. prophata* OBERH. [2]) of the Malay States, Sumatra and Borneo but larger, the male with the black gorget obsolete and the female with the tail strongly washed with blue.

Type. Adult male collected on Seroetoe, Karimata Islands, west Borneo on 24th March 1931 by L. COOMANS DE RUITER. Coll. No. 133. Wing 76.5 mm.; tail 75 mm.

Specimens examined. Panebangan, Pelapis, Karimata Besar, Seroetoe. 6 ♂, 4 ♀ 1 juv. (24.3.31).

Wings, ad. ♂ 75, 74, 72, 78, 77; ♀ 74, 74, 73, 68 mm.

Remarks. Large races of *Hypothymis azurea* exist in the Anamba Islands *(opisthocyanea* OBERH.) and the Natuna Islands *(giganoptera* OBERH.) but in both these forms the male has a well developed black gorget. In one male of *karimatensis* the gorget is represented by a thin black line; in the other adult males only a few of the feathers on the foreneck are narrowly margined with black and in three specimens no trace of the gorget can be seen unless the plumage is disturbed.

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[1]) Bull. Raffles Mus., 7, 1932, p. 8.

[2]) *Hypothymis azurea prophata* OBERH.: Proc. U. S. Nat. Mus., 39, 1911, p. 597: Karimon Island, Rhio Archipelago.

PYCNONOTIDAE.

Pycnonotus brunneus brunneus MOORE.

Panebangan, Pelapis, 2 ♂.

Wing, ad. ♂ 89 mm. „Iris red".

A large bird but similar specimens occur in Borneo and Sumatra and in the absence of series we do not refer the Karimata race to *P. b. zapolius* OBERH. of the Anamba Islands which is like typical *brunneus* but shows a slightly higher average wing-length.

TURDIDAE.

Kittacincla malabarica tricolor (VIEILL.).

Karimata Besar, Seroetoe, 5 ♂, 1 ♀.

Wings, ♂ 100, 99, 100, 98, 101; ♀ 90 mm.

It is interesting to find that the Karimata race is *tricolor* which occurs in west Java (terr. typ.) and Sumatra and not the very distinct *suavis* which inhabits west Borneo. All the specimens have the three outer rectrices black at the base. The amount of white on the fourth rectrix is variable. One male from Seroetoe is less deeply chestnut below than the others.

STURNIDAE.

Gracula javana javana (CUV.).

Panebangan, Karimata Besar, Seroetoe. 2 ♂, 1 ♀.

Wings, ♂ 179, 180; ♀ 181 mm.

Aplonis panayensis heterochlorus (OBERH.).

Lamprocorax panayensis heterochlorus (OBERH)., Bull. U. S. Nat. Mus., 98, 1917, p. 57: Anamba Islands.

Panebangan, Karimata Besar. 2 ♂, 1 ♀.

Wings, ♂ 107, 107; ♀ 104 mm.

This long-winged, large-billed race has been discussed at length by KLOSS in Treubia, 12, 1930, p. 420.

NECTARINIIDAE.

Chalcostetha calcostetha calcostetha (JARD.).

Karimon Besar, 1 ♂, 1 ♀.

Wings, ♂ 61; ♀ 55.5 mm.

Anthreptes malacensis malacensis (SCOP.).

Anthreptes malacensis anambae OBERHOLSER, 1924, p. 4.

Panebangan, Pelapis, Karimata Besar, Seroetoe. 12 ♂, 6 ♀.

Wings, ad. ♂ 68, 68, 67, 66, 65; ♀ 60, 61, 61, 62, 62 mm.

Aethopyga siparaja siparaja (RAFFLES).

Aethopyga siparaja ochropyrrha OBERH., p. 4.

Panebangan, 5 ♂.

Wings, ad. ♂ 52, 52, 51.5, 52 mm.

These males show the usual rather wide range of variation in the colour of the posterior underparts seen in this species in any one locality. There is also considerable difference in the tone of the red parts when the lightest and darkest skins are compared.

Leptocoma jugularis pectoralis (HORSF.).

Panebangan, Pelapis, Boeroeng, Karimata Besar, Oema (birds' nest island), 4 ♂, 8 ♀.

Wings, ad. ♂ 54, 52, 54, 54; ♀ 50.5, 51.5, 49, 49, 53 mm.

DICAEIDAE.

Dicaeum cruentatum subsp.

Panebangan, Pelapis, Karimata Besar, 4 ♂, 1 ♀.

Wings, ad. ♂ 49, 48; ♀ 45 mm.

Only two of the males are adult. One has the chin entirely white: the other bird is in bad condition but it appears to have had a few black feathers on the chin. Birds similar to each of these specimens are found in the Malay States *(ignitum* BEGBIE) and Sarawak *(nigrimentum* SALVAD.) and it is therefore not possible to allocate the Karimata race to a subspecies until a better series of males is obtained.

Dicaeum trigonostigma trigonostigma (SCOP.).

Karimata Besar, Seroetoe, 5 ♂, 1 ♀.

Wings, ad. ♂ 49, 50.5, 51, 52, 52 mm.

The Karimata race of *D. trigonostigma* is a little unstable but it is definitely nearer to the typical race than to topotypical *D. t. dayakana* from British North Borneo.

As a series the Karimata birds average darker on the throat than *dayakana* and one specimen is as pale as the palest of a large series of *D. t. trigonostigma* from the Malay Peninsula and Sumatra. Pale throated birds, by themselves inseparable from typical *trigonostigma,* also occur sporadically in Sarawak.

ZOSTEROPIDAE.

Zosterops chloris maxi FINSCH.

Boeroeng, 1 ♂.

Wing, 55 mm.

We cannot separate this specimen from a small series of topotypical *maxi* from the Thousand Islands off the northwest coast of Java and some from the Karimoen Djawa Islands (postea p. 171).

The wing range of four topotypes of *maxi* is 56.5 - 58 mm. and the smallest bird of ten before us from the Karimoen Djawa Islands has the wing 56 mm. in length. The Karimata specimen with a wing only 55 mm. in length is therefore rather small.

Z. c. maxi is very close to *intermedia* of Celebes and it has yet to be demonstrated in what way *solombensis* OBERH., and *zachlora* OBERH., from small islands in the Java Sea differ from *maxi* or *intermedia*.

ON A SMALL COLLECTION OF BIRDS FROM THE KARIMOEN DJAWA ISLANDS.

By

F. N. CHASEN and C. BODEN KLOSS

(Raffles Museum, Singapore).

The Karimoen Djawa (Karimon Java) Islands are a group of very small islands in the Java Sea lying slightly east of the centre point of the north coast of Java and about 38 miles from it.

Karimoen Djawa Island is the largest of the group and measures approximately four miles in each of its two greatest dimensions.

Between the islands and the Java coast there are depths of about 30 fathoms. Between the south coast of Borneo and the Karimoen Djawa islands soundings of 38 fathoms are recorded.

Collectors from the Zoological Museum, Buitenzorg obtained birds on the main island of the group in May 1926 (7th-16th) and again in November 1930 (23rd-30th). On the latter occasion Pulau Kĕleang (Gelean, Gleang, or Klejang) an islet a few miles southwest of Karimoen Djawa island was also visited. Unless otherwise indicated all the birds in the present collection come from the main island.

A very full description of the group with a map and tentative lists of the flora and fauna was published by S. H. KOORDERS in 1888 [1]).

Judging from the accounts of KOORDERS and VORDERMAN a few other species also seem to occur in the Karimoen Djawa Islands, but it is not certain in all cases whether their records are based on specimens obtained, or merely listed on visual evidence, or even native testimony.

Excluding migrants and certain widely spread birds of a pronounced marine habitat we find that of the remaining seventeen resident species occurring in the Karimoen Djawa Islands five birds occur in exactly the same form in Java and south Borneo: *Geopelia s. striata, Halcyon chloris cyanescens, Gerygone fusca sulphurea, Chalcostetha c. calcostetha* and *Dicaeum trochileum*.

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[1]) „Verslag van eene dienstreis naar de Karimon-Djawa-Eilanden" door S. H. KOORDERS, Natuurkundig Tijdschrift voor Ned. Indië, Deel XLVIII, 1888, pp. 20-132. See also VORDERMAN, tom. cit., pp. 145-147.

The remaining species indicate a close relationship between the avifaunas of the Karimoen Djawa islands and Java.

Where a species is represented in south Borneo and Java by different subspecies if it occurs in the Karimoen Djawa Islands it is either represented there by the Javan race *(Hypothymis azurea javana, Muscitrea grisola butaloides, Lalage n. nigra, Pycnonotus goiavier analis* and *Artamus leucoryn amydrus),* or by a race which is, according to the present state of our knowledge, confined to the Karimoen Djawa Islands *(Psittacula alexandri dammermani, Cyornis rufigastra longipennis* and *Orthotomus sepium palliolatus),* or else found in the same or a very slightly altered state on other small islands in the Java Sea *(Ducula r. rosacea, Ptilinopus melanocephala bangueyensis, Anthreptes malacensis baweanus* and *Zosterops chloris maxi).*

The collection before us contains the following forms:—

TRERONIDAE.

Ducula rosacea (TEMM.)

Wings, ♂ 227; ♀ 233, 218 mm.

D. r. zamydrus OBERH. [1]) from the islands of Solombo Besar and Arends in the east Java Sea is said to be darker than *D. r. rosacea* of Timor and „with the metallic sheen on interscapular region and posterior parts more evident (less overlaid with grey)".

The specimens from Karimoen Djawa are paler and have less metallic sheen than a bird from Romah Island which almost certainly belongs to the typical form originally described from Timor. This suggests that the characters relied upon for the separation of *zamydrus* are not of racial significance.

Ptilinopus melanocephala bangueyensis MEYER.

1 ♂, 2 ♀.

Wings, ad. ♂ 124; ♀ 126 mm.

Our series of typical *melanocephala* of Java gives the following wing-ranges, males 110 - 119 mm.; females 112 - 119 mm. We therefore refer these large birds from Karimoen Djawa to *bangueyensis,* an ill-defined race which can, however, be maintained on its slightly larger size (see HARTERT, Nov. Zool. X, 1903, p. 33) occurring in the north Bornean islands, the southern Philippines and the Sulu Archipelago. Our birds do not show the colour distinctions attributed to *massoptera* OBERH., also a large form, described from Poeloe Mata Siri in the east Java Sea.

[1]) *Muscadivores rosaceus zamydrus* OBERHOLSER, Proc. U. S. Nat. Mus., 54, 1917, p. 179.

The adult female from Karimoen Djawa has more pink in the under tail-coverts than any Javan female before us.

COLOMBIDAE.

Caloenas nicobarica nicobarica (LINN.).

1 ♀ (24 Nov.).

Geopelia striata striata (LINN.).

1 imm. ex.

LARIDAE.

Sterna bergii cristatus STEPHENS.

2 ♂, 3 ♀.

Culmens, ♂ 59, 65; ♀ 59, 60 mm.

Anous stolidus pileatus (SCOP.).

CHARADRIIDAE.

Tringa hypoleucos LINN

Karimoen Djawa and Poeloe Kĕleang.

2 ♂, 3 ♀ (27, 29 Nov.).

Wings, ♂ 106, 107; ♀ 110, 111, 108 mm.

Tringa ochropus LINN.

1 ♀ (26 Nov.).

Wing, ♀ 144 mm.

MATHEWS (Syst Av. Austr. 1, 1927, p. 169) includes the Malay Peninsula in the range of this species but we do not know on what authority. HARTERT (Vög. pal. Fauna, 2, p. 1618) casts doubts on GOULD's bird from Borneo and the specimen before us is therefore of special interest confirming the fact that the Green Sandpiper occurs as a migrant in Malaysia where, however, it must be very rare.

Capella stenura (KUHL).

2 ♂ (30 Nov.).

Wings, ♂ 135, 133 mm.

Glareola pratincola maldivarum FORSTER.

1 ♀ (29 Nov.).

Wing, ♀ 177 mm.

ARDEIDAE.

Ardeola speciosa (HORSF.).

1 ♂.

Wing, ♂ 195 mm.

Demiegretta sacra sacra (GMEL.)

2 ♀.

Wings, 259, 250 mm.

One in the white and one in the black phase.

Ixobrychus sinensis sinensis (GMEL.)

2 ♂, 2 ♀. (28, 29, 30 Nov.).

Wings, ad. ♂ 132.

Ixobrychus eurhythmus (SWINH.).

2 ♀ (28, 29 Nov.).

Wings, ♀ 143, 144 mm.

Both immature.

PANDIONIDAE.

Pandion haliaëtus cristatus (VIEILL.).

1 ♀ (11 May).

Wing, 450 mm.

A small, white-headed bird.

PSITTACIDAE.

Psittacula alexandri dammermani CHAS. & KLOSS [1])

Like *P. a. alexandri* of Java but much larger.

Type. - Adult female collected on Karimoen Djawa Island, Java Sea, on 15th May 1926 by Dr. K. W. DAMMERMAN. Buitenzorg Museum No. 4014. Wing, 173 mm.

Specimens examined. - 6 males and 5 females, all from Karimoen Djawa Island.

Wings, ♂ 173, 175 (+ ?) 170; ♀ 166, 170, 173 (type) mm.

Remarks. - Unfortunately some of the specimens listed have imperfect wings but the available measurements clearly indicate a race larger than *P. a. alexandri* of which our series from east and west Java give the following wing-ranges:- males 145 - 155 mm.; females 146 - 148 mm. The bill of *dammermani* is also more robust than that of typical *alexandri*. The two forms are very much alike in colour although no Javan bird before us has the top of the head so deeply blue as in several examples of the new race: but this is a character much influenced by abrasion of the plumage and at the moment we do not use it for distinguishing the two races. Several large races of this parrot have been described from islands off the west coast of Sumatra but in colour they are all much nearer to the very distinct northern form, *P. a. fasciatus* which is otherwise only found as far south as Peninsular Siam.

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[1]) Bull. Raffles Mus., 7, 1932, p. 8.

ALCEDINIDAE.

Halcyon sancta sancta VIG. & HORSF.

1 imm. ♀ (14 May).

Halcyon chloris cyanescens (OBERH.)

Karimoen Djawa and Poeloe Kĕleang, 3 ♂, 5 ♀, 2 unsex. ex.

Wings, ♂ 112, 115, 112; ♀ 115, 111, 108, 118, 116 mm.

CUCULIDAE.

Eudynamys scolopacea malayana CAB. & HEINE.

4 ♂, 3 ♀ (8-13 May, 28 Nov.).

Wings, ♂ 206, 204, 210, 204; ♀ 208, 212, 204 mm.

The females all of the rufous kind.

MUSCICAPIDAE.

Muscitrea grisola butaloides (STRES.).

Pachycephala grisola butaloides STRESEMANN, Treubia, XI, 1929, p. 135: west Java.

3 ♂, 2 ♀.

Wings, ♂ 86, 86, 86; ♀ 85, 84 mm.

Cyornis rufigastra longipennis CHAS. & KLOSS.

Cyornis rufigastra longipennis CHAS. & KLOSS, Treubia, XII, 1930, p. 271: Karimoen Djawa Island.

2 ♂, 3 ♀.

Wings, ♂ 78, 79; ♀ 75, 76.5, 74 mm.

This race is very near to *C. r. karimatensis* OBERH., but it is rather duller above and below. The original series was collected in 1926, the present examples in 1930.

Hypothymis azurea javana CHAS. & KLOSS.

Hypothymis azurea javana CHAS. & KLOSS, Bull. Raffles Mus., 2, 1929, p. 22: Badjoelmati, east Java.

1 ♀.

Wing, 69 mm.

Compared with females of *H. a. prophata* OBERH., from various parts of its range this single female is greyer above: it is also tinged with blue on the mantle and we therefore refer it to the Javan race.

Cyanoptila cyanomelana cumatilis THAYER & BANGS.

1 ♂ (25 Nov.).

Wing, 94 mm.

Gerygone fusca sulphurea WALL.

2 ♂, 2 ♀.

Wings, ♂ 53, 52; ♀ 50, 49.5 mm.

CAMPEPHAGIDAE.

Lalage nigra nigra (FORST.).

1 ♂ (30 Nov.).

Wing, 88 mm.

An immature bird.

PYCNONOTIDAE.

Pycnonotus goiavier analis (HORSF.)

6 ♂, 4 ♀.

Wings, ♂ 95, 94, 93, 92, 92; ♀ 86, 86.5, 85, 88 mm.

Perhaps a little more heavily marked below than *P. g. analis* of Java and therefore tending to approach *P. g. gourdini* (JACQ. and PUCH.) described from south Borneo.

SYLVIIDAE.

Orthotomus sepium palliolatus CHAS. & KLOSS. [1])

Like *O. s. cineraceus* BLYTH of the Malay Peninsula and Sumatra but the chestnut areas of the head paler.

Type. - Adult male collected on Karimoen Djawa Island, Java Sea, on 12 th May 1926 by Dr. K. W. DAMMERMAN. Buitenzorg Mus. No. 3998. Wing, 52.5 mm.

Specimens examined. - Four males and one female from the type locality compared with a large series of topotypical *cineraceus.*

Remarks. - In the general tone of the upperparts *palliolatus* seems exactly like *cineraceus,* but on the underparts it happens that the small series of the former is distinctly whiter below, especially on the throat and breast. We do not, however, attach much importance to this character. Two of the males of the new form are perhaps rather younger than the other two, but as in the case of the female and other males they have been compared with specimens of *cineraceus* in a similar stage of plumage and all are distinctly less richly chestnut and more yellow on the head: the difference is particularly noticeable on the ear-coverts.

This new form is not improbably the bird occurring in the lowlands of the north coast of Java listed by BARTELS and STRESEMANN (Treubia, XI, 1929, p. 133) as *O. s. cineraceus* BLYTH.

Wings, ♂ 51, 52.5, 51, 52.5 mm.

Acrocephalus stentoreus orientalis (TEMM. & SCHLEG.).

1 ♂, 1 ♀ (24, 26 Nov.).

Wings, ♂ 90; ♀ 81 mm.

Phylloscopus borealis borealis (BLAS.).

1 ♂ (26 Nov.).

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[1]) Bull. Raffles Mus., 7, 1932, p. 9.

LANIIDAE.

Lanius cristatus superciliosus (SUTH.).

1 ♂ (24 Nov.).

Wing, 90 mm.

ARTAMIDAE.

Artamus leucoryn amydrus OBERH.

4 ♂, 2 ♀.

Wings, ♂ 131, 128; ♀ 127, 132 mm.

MOTACILLIDAE.

Motacilla flava simillima HART.

1 ♂, 1 ♀ (30 Nov.).

Wings, ♂ 77; ♀ 77.5 mm.

NECTARINIIDAE.

Anthreptes malacensis baweanus OBERH.

Anthreptes malacensis baweanus OBERHOLSER, Proc. U. S. Nat. Mus., 52, 1917, p. 196: Bawean Island, Java Sea.

Wings, 68, 67, 69, 70 mm.

These males have longer, heavier bills than all but one or two examples in a very large series of typical *malacensis:* we therefore refer them to *baweanus* the type male of which has, fide OBERHOLSER, the exposed culmen 17.8 mm. in length. Exposed culmens (to edge of feathers) 16.75, 16.5, 16.8, 17.4 mm.

Chalcostetha calcostetha calcostetha (JARD.).

1 ♀.

DICAEIDAE.

Dicaeum trochileum (SPARRM.).

7 ♂, 2 ♀.

Wings, ad. ♂ 53, 52, 52, 52, 53.5, 53; ♀ 50.5, 50 mm.

ZOSTEROPIDAE.

Zosterops chloris maxi FINSCH.

Karimoen Djawa and Poeloe Kĕleang 7 ♂, 3 ♀.

Wings, ♂ 57, 57, 56, 57, 57, 56, 56; ♀ 56, 56 mm.

Not separable from topotypes of *maxi* from the Thousand Islands off the northwest coast of Java.

CAMPEPHAGIDAE.

Lalage nigra nigra (FORST.).
1 ♂ (30 Nov.).
Wing, 88 mm.
An immature bird.

PYCNONOTIDAE.

Pycnonotus goiavier analis (HORSF.)
6 ♂, 4 ♀.
Wings, ♂ 95, 94, 93, 92, 92; ♀ 88, 86.5, 85, 88 mm.

Perhaps a little more heavily marked below than *P. g. analis* of Java and therefore tending to approach *P. g. gourdini* (JACQ. and PUCH.), described from south Borneo.

SYLVIIDAE.

Orthotomus sepium palliolatus [illegible]

Like *O. s. cineraceus* BLYTH of the Malay Peninsula and Sumatra but the chestnut areas of the head paler.

Type. - Adult male collected on Karimoen Djawa Island, Java Sea, on 12 th May 1926 by Dr. K. W. DAMMERMAN. Buitenzorg Mus. No. 3998. Wing, 52.5 mm.

Specimens examined. - Four males and one female from the type locality compared with a large series of topotypical *cineraceus*.

Remarks. - In the general tone of the upperparts *palliolatus* seems exactly like *cineraceus*, but on the underparts it happens that the small series of the former is distinctly whiter below, especially on the throat and breast. We do not, however, attach much importance to this character. Two of the males of the new form are perhaps rather younger than the other two, but as in the case of the female and other males they have been compared with specimens of *cineraceus* in a similar stage of plumage and all are distinctly less richly chestnut and more yellow on the head: [illegible] noticeable on the ear-coverts.

This new form [illegible] of the north coast of Java listed by BARTELS and STRESEMANN (Treubia, XI, 1929, p. 133) as *O. s. cineraceus* BLYTH.

Wings, ♂ 51, 52.5, 51, 52.5 mm.

Acrocephalus stentoreus orientalis (TEMM. & SCHLEG.).
1 ♂, 1 ♀ (24, 26 Nov.).
Wings, ♂ 90, ♀ 81 mm.

Phylloscopus borealis borealis (BLAS.).
1 ♂ (26 Nov.).

[1] Bull. Raffles Mus., 7, 1932, p. 9.

POLYCHAETEN UND HIRUDINEEN AUS DEM ZOOLOGISCHEN MUSEUM IN BUITENZORG.

Von

H. AUGENER

(Hamburg).

Die vorliegende Arbeit enthält die Untersuchung über ein kleineres im Zoologischen Museum in Buitenzorg auf Java aufbewahrtes Material von Polychaeten und Hirudineen, das mir von Herrn Dr. K. W. DAMMERMAN in Buitenzorg freundlichst zur Bearbeitung zugesandt wurde. Die Fundorte des Materials entstammen verschiedenen Gebieten von Niederländisch-Indien, zu denen sich ein Polychaeten-Fundort von Australien hinzugesellt.

Die mit 29, auf 10 Familien und 21 Gattungen verteilten Arten vertretenen, meist marinen Polychaeten enthalten mit einer Ausnahme bekannte Formen, aber mehrere interessante Arten, über die kurz folgendes hier bemerkt sein mag. Von *Amphinome rostrata* PALL. konnte abermals das Vorkommen von Brutpflege festgestellt werden. Bei *Chloeia parva* BAIRD ist das pelagische Auftreten bemerkenswert. *Odontosyllis gibba* CLAP. und *Odontosyllis fulgurans* CLAP. var. *arenicolor* GR. von denen mir nur die pelagischen Geschlechtstiere vorlagen, sind ausgezeichnet durch ihr Leuchtvermögen; zu *Odontosyllis fulgurans* CLAP. var. *arenicolor* GR. nehme ich an, die gleicherweise aus dem Indo-Malayischen Gebiete stammende agame Form in einer vor mehr als 50 Jahren beschriebenen Art aufgefunden zu haben. Aus der Familie *Nereidae* wurde die marine *Nereis (Platynereis) dumerili* AUD. & EDW auch in schwach salzhaltigem Wasser auf einer kleinen Insel gefunden. *Lycastis ranauënsis* FEUERB., eine Süsswasser-Nereide aus Sumatra, findet sich auch auf Java, während die Auffindung einer anderen Süsswasser-Nereide, der *Lycastopsis catarractarum* FEUERB. aus Sumatra und Java, nach einem nicht dieser Sammlung angehörenden, hier mit verwerteten Funde auf Ambon eine weitere Verbreitung dieser letzteren Art in Niederländisch-Indien vermuten lässt. — Sämtliche Polychaeten-Arten dieser Sammlung haben eine mehr oder weniger ausgedehnte Verbreitung auf der Osthalbkugel. Eine Anzahl von Arten kommt zugleich auf der Westlichen gleich Atlantischen Halb-

kugel vor, sei es auch im Rahmen von Varietäten, und z.T. im europäischen Meeresgebiet: *Amphinome rostrata* PALL., *Eurythoë complanata* PALL., *Laetmatonice filicornis* KINB., *Lepidonotus (Thormora) jukesi* BAIRD, *Hesione pantherina* RISSO var.. *splendida* SAV., *Syllis (Typosyllis) krohni* EHL., *Odontosyllis gibba* CLAP., *Odontosyllis fulgurans* CLAP. var. *arenicolor* GR., *Nereis (Platynereis) dumerili* AUD. & EDW., *Arabella iricolor* MONT., *Sabellastarte magnifica* SHAW, *Branchiomma vesiculosum* MONT. Bezüglich der Polychaeten muss ich auch verweisen auf meine im gegenwärtigen Augenblick noch nicht veröffentlichte Bearbeitung von Polychaeten aus den Zoologischen Museen von Leiden und Amsterdam, unter denen sich ein grosses Material indo-malayischer Formen befindet.

Die 11 Arten von Hirudineen, süsswasser- und landbewohnende Formen, verteilen sich auf 4 Familien und 9 Gattungen. Ihre Untersuchung bildet eine Ergänzung zu meinen Arbeiten über die Hirudineen der Deutschen Limnologischen Sunda-Expedition und der Expedition des Prinzen LEOPOLD von Belgien nach Niederländisch-Indien.

Ein Verzeichnis der gefundenen Polychaeten und Hirudineen, nach Familien geordnet, gebe ich auf nachstehender Tabelle.

Verzeichnis der Polychaeten und Hirudineen.

I. POLYCHAETA.

Fam. Amphinomidae.

Amphinome rostrata PALL.
Chloeia flava PALL.
„ *parva* BAIRD
Eurythoë complanata PALL.
Hermodice striata KINB.

Fam. Aphroditidae.

Laetmatonice filicornis KINB.

Fam. Polynoidae.

Lepidonotus (Thormora) jukesi BAIRD

Fam. Phyllodocidae.

Sphaerodoce quadraticeps GR.

Fam. Hesionidae.

Hesione pantherina RISSO var. *splendida* SAV.

Fam. Syllidae.

Syllis (Typosyllis) exilis GRAV.
„ „ *krohni* EHL.
Opisthosyllis australis AUG.
Odontosyllis gibba CLAP.
„ *fulgurans* CLAP. var. *arenicolor* GR.

Fam. Nereidae.

Nereis jacksoni KINB.
„ *(Perinereis) perspicillata* GR.
„ *(Platynereis) dumerili* AUD. & EDW.
Lycastis ranauënsis FEUERB.

Fam. Eunicidae.

Eunice (Eriphyle) aphroditois PALL.
„ *antennata* SAV.
„ *australis* QUATR.
„ *coccinea* GR.
Marphysa soembaënsis n.sp.
Arabella iricolor MONT.

Fam. Flabelligeridae.

Stylarioides parmatus GR.

Fam. Sabellidae.

Sabellastarte magnifica SHAW
Spirographis tricyclia SCHM.
Branchiomma vesiculosum MONT.
Dasychone cingulata GR.

II. HIRUDINEA.

Fam. Hirudinidae.

Limnatis (Hirudinaria) javanica WAHLB.
Hirudo spec.

Fam. Haemadipsidae.

Haemadipsa zeylanica MOQU.-TAND.
„ *silvestris* R. BLANCH.
„ spec.
Chtonobdella tristriata GODD.

Fam. N e p h e l i d a e.

Barbronia weberi R. BLANCH.
Herpobdelloidea lateroculata KAB.
Scaptobdella horsti R. BLANCH.

Fam. C l e p s i n i d a e.

Clepsine weberi R. BLANCH.
Haementeria fulva HARD.

I. POLYCHAETA.

Fam. A m p h i n o m i d a e.

Amphinome rostrata PALL.

F u n d o r t: Madoera-Strasse. III. 1908. — P.A. OUWENS.
Madoera-Strasse. Zwischen Java und Madoera. — P.A. OUWENS.

Von den wenigen Exemplaren dieser Art stammt eines van den 2ten Fundort. Die Maximallänge beträgt bei vollständige Erhaltung ca. 70 mm bei einer Zahl von ca. 50 Borstensegmenten. Die Färbung ist jetzt graugelb-bräunlich mit einer Spur von Fleischfarbe. Diese Würmer haben eine mehr gedrungene, etwas raupenförmige Körperform, sind allerdings vorn wenig, in der hinteren Körperhälfte erheblich nach hinten zu verschmälert. Wennschon sie so in ihrer Gesamtform wie in ihrer Grösse ganz gut zu der *Amph. nigrobranchiata* HORST (1912) passen würden, so können sie doch nach ihrer Borstentracht nicht zu der letzteren Art gehören, stimmen in diesem Punkte vielmehr mit *Amph. rostrata* überein und müssen daher als *Amph. rostrata* benannt werden. Im einzelnen ist über diese Würmer noch folgendes zu bemerken. Die Karunkel reicht bis ans 2te Segment, die Kiemen beginnen am 3ten Segment. Die Mundöffnung wird hinten vom 4ten Segment begrenzt tatsächlich, wenn es auch bei gewisser Körperspannung scheinbar so aussieht, als wenn das 3te Segment hinten die Mundöffnung begrenzte. — Die Dorsalborstenbündel sind umgekehrt wie bei *Amph. nigrobranchiata* viel länger und borstenreicher als die Ventralborstenbündel und enthalten glatte Borsten, ausserdem sind vereinzelte Borsten mit einer schwachen Sägezähnelung vorhanden. Die Hakenborsten der Ventralbündel sind kräftig und lassen bei

guter Erhaltung ein kleines sekundäres Zähnchen an der konkaven Seite der Spitze erkennen, das allerdings durch Abnutzung mehr oder weniger verloren gehen kann. — Eines von den Tieren vom 1sten Fundort scheint hinten mit einer ansehnlichen Strecke in weit vorgeschrittener Regeneration zu sein.

An den Exemplaren des 1sten Fundortes fanden sich mehrere Junge, ein Junges auch an dem Exemplar vom 2ten Fundort. Ein grösseres Junges von ca. 6,5 mm Länge hat ca. 23, ein kleines Junges von ca. 3 mm Länge ca. 18 Segmente. An den Ventralborsten der Jungen ist zuweilen das sekundäre Zähnchen überhaupt nicht erkennbar; wenn das Zähnchen erkennbar ist, sieht es ganz klein und kurz aus, wie ein heller Punkt, und befindet sich an der konkaven Kante der Borstenendspitze da, wo die Endspitze sich zu krümmen beginnt. Nachdem ich an Individuen der *Amph. rostrata* aus dem Nordatlantik und von Neu-Guinea Junge beobachtet habe, konnte ich jetzt zum dritten Male diese Beobachtung machen.

Als Nahrung dieser Würmer habe ich an einem der grössten Exemplare des 1sten Fundortes Lepadiden, in deren Gesellschaft diese Amphinomen sich mit Vorliebe aufhalten, festgestellt. In Darm in der hinteren Körperhälfte befanden sich, die Körperwand stumpfkantig mehr oder weniger vortreibend, alle wohlerhaltenen Schalenstücke einer Lepadide. Von diesen sind die Scutalplatten ca. 12 mm lang und ca. 9 mm maximalbreit, die Tergalplatten ca. 11 mm lang, die Carina ist ca. 9 mm lang.

Junge wurden von HORST (1912) an der indo-malayischen *Amph. pulchra* beobachtet, die wie die *Amph. nigrobranchiata* HORST keine eigentliche Amphinome im Sinne der *Amph. rostrata* ist und andersgestaltete Borsten hat.

Chloeia flava PALL.

Fundort: Australien. Queensland, Port Alma. VI. 1921. — V. D. POEL.
Südl. Aroe-Ins. Bei Krei; marin. 1907. — TISSOT VAN PATOT.

Von Australien liegen 2 gross gut erhaltene Exemplare vor, deren Borstenfärbung bis auf Spuren verschwunden ist. Das längere Tier, ca. 150 mm total lang bei einer Breite ohne Parapodien von ca. 30 mm, hat 40 Borstensegmente. An dem kürzeren Wurm, der ca. 110 mm lang und ca. 26 mm breit ist, ist hinter dem auf beiden Körperseiten normal entwickelten 40ten Borstensegment auf der einen Seite noch ein rudimentäres 41tes Parapod entwickelt.

Das einzige, total ca. 60 mm lange Exemplar von den Aroe-Inseln ist ziemlich schlecht erhalten und zeigt keine gelbe Färbung mehr an den Ventralborsten. In Massen zusammengewirrt in Alkohol haben die Borsten einen gelbrötlichen Hauch. Die dunklen segmentalen dorso-medianen Flecken haben die Grösse und Form wie bei *Chl. flava,* sie sind nahezu kreisförmig oder kurz und breit längs-oval.

Chloeia parva BAIRD.

Fundort: Banka. Klaba-Bucht. 2. IV. 1909. An der Oberfläche.—
Exped. S.S. Gier. Nr. 19.

Das einzige Exemplar wurde pelagisch an der Meeresoberfläche gefangen und ist ein vollständiger Wurm von ca. 42 mm Länge und ca. 9 mm Maximalbreite exklus. Parapodien, und enthält 33 Borstensegmente. Die Körperfärbung ist jetzt graugelblich ohne anderweitige Körperzeichnung im Sinne der *Chl. parva,* wie sie HORST (1912) beschreibt, die Borsten sind farblos. Am Vorderkörper mag die Dorso-mediane jederseits bräunlich besäumt gewesen sein, Sicheres lässt sich nicht darüber sagen.

Der unpaare Kopffühler ist etwa 2/3 so lang wie die Karunkel. Letztere reicht über die 3 ersten Segmente hinweg ungefähr bis ans 4te Segment nach hinten, ihr Mittelwulst hat mindestens 20 (ungefähr 22 ?) schlecht zu zählende Querfalten. Der mit braunem Längsstreifen versehene Mittelwulst ist gegen die Seitenwülste durch braune Streifen abgegrenzt. Die Mundöffnung wird hinten vom 4ten Segment begrenzt.

Da der Kopf tief abwärts gedrückt ist, sind die Kopfaugen schwer zu untersuchen und von oben her nicht recht zu erkennen. Die Augen erscheinen mir grösser und auf jeder Kopfseite noch etwas näher aneinander gerückt als z.B. in der Abbildung einer fundicolen *Chl. fusca* MCINT. (MCINTOSH 1885), einer nach HORST (1912) gleichfalls auch pelagisch vorkommenden Art.

Die Kiemen beginnen am 4ten Segment, und die des 1sten Paares sind kleiner als die folgenden und besonders die vollentwickelten Kiemen des Mittelkörpers, doch nicht als rudimentär zu bezeichnen. Die Kiemen sind sitzend, solche vom Mittelkörper (15tes Segment) haben jederseits 7 primäre Nebenäste, von denen der unterste jederseits der stärkste von allen ist; der unterste mediale Nebenast ist länger als der unterste lateral an der Kieme stehende Nebenast. Abgesehen von dem untersten Primärastpaare haben die übrigen Primäräste mehr oder weniger Sekundäräste, mit Ausnahme von vielleicht 2 obersten Primärästen, die keine Sekundäräste besitzen. An dem lateralen untersten Primärast sind die Sekundäräste viel länger und stärker als die Sekundäräste der übrigen Primäräste und tragen noch wieder trinäre Nebenäste; an dem medialen untersten Primärast ist doch mindestens ein Sekundärast wieder mit trinären Nebenästen versehen. Die Kiemen als Ganzes genomen, haben etwa einen halbkreisförmigen Umriss.

Die Borsten bezeichne ich als mässig lang; am Hinterkörper, wo der Wurm schmäler wird, sind sie im Verhältnis länger als am Mittelkörper. Die Ventralborsten sind erheblich zarter als die Dorsalborsten und als Bündel etwa 1½ mal so lang wie die Dorsalborstenbündel; in der breitesten Körpergegend sind die Ventralborstenbündel etwa halb so lang wie der Körper breit. Den folgenden Angaben über die Borsten sei vorausgeschickt, dass

HORST (1912) die *Chl. merguiensis* (BEDDARD 1889) als Synonym mit *Chl. parva* vereinigt hat.— Dorsalborsten aus der Gegend des 20ten bis 23ten Segments sind an ihrer Endstrecke im Profil einseitig grob gesägt. Lange Borsten aus dem oberen Teil des Bündels haben ca. 19 — 22 Sägezähne, Borsten unten aus dem Bündel weniger, 15 oder 16 Sägezähne. HORST, nach dessen Abbildung von *Chl. parva* die Zahl der Sägezähne in der Zahnreihe geringer ist als im Maximum bei meinem Tier, erwähnt und abbildet noch ein winziges Zähnchen an diesen Borsten, das an der der gesägten Borstenkante entgegengesetzten Borstenkante etwas unterhalb des unteren Endes der Sägezahnreihe entspringt und nur an frischem Formalinmaterial erkennbar sein soll. Ich meine, dass ich sogar auch 2 solche Bildungen erkenne, die sozusagen im Niveau der Borstenoberfläche liegen, immerhin an ihrem Vorderende minimal abgezetzt sind. Wenn HORST die Dorsalborsten der ersten 5 Segmente als gegabelt und der Zähne entbehrend charakterisiert, so muss ich ihm darin beistimmen. Dorsalborsten z.B. vom 4ten Segment sind glatt, d.h. glatt speziell auch an der Strecke, an welcher bei den Dorsalborsten vom Mittelkörper die Sägezähne stehen. Ein zwar ganz kurzer, aber deutlicher Sekundärzahn ist der kurze Ast dieser gegabelten vorderen Dorsalborsten. BEDDARD bemerkt von *Chl. merguiensis,* dass ein grosser Teil des Schaftes der gesägten Dorsalborsten durch schwache Einschnürungen markiert ist und dadurch quergestreift aussieht. Ich sehe unterhalb der Sägezahnreihe zum mindesten einige Querlinien, die der erwähnten Querstreifung entsprechen mögen. Die Ventralborsten sind glatt, ihre kürzere Gabelzinke ist kurz, 1/5 bis höchstens 1/4 so lang wie die lange Zinke, zuweilen noch kürzer, zuweilen auch noch länger, ca. 1/3 so lang wie die lange Zinke.

Ich bin mit HORST der Ansicht, dass *Chl. merguiensis* die gleiche Art ist wie *Chl. parva.* Die Körperform des vorliegenden Wurmes ist gestreckt, deutlich abgeplattet, gegen beide Körperenden, namentlich gegen das Hinterende verschmälert und passt in seinen Dimensionen zu *Chl. merguiensis.* BEDDARD bezeichnet die Körperform derselben als „elongate not ovoid". Wenn auch an dem vorliegenden Wurm von der sonst an *Chl. parva* beobachteten farbigen Zeichnung nichts Sicheres zu finden oder nicht mehr zu erkennen ist, so halte ich ihn doch für ein wegen seines pelagischen Vorkommens bemerkenswertes Exemplar der *Chl. parva.*

Eurythoë complanata PALL.

Fundort: Madoera-Strasse. III. 1908. — P.A. OUWENS.
Bai von Batavia (Java). Insel Dapoer. 4 VI. 1930.— J. VERWEY.

Der Erhaltungszustand und die Verbiegung der wenigen vorliegenden Exemplare beeinträchtigt erheblich die Erkennung von bei dieser Amphinomide so häufig auftretenden Regenerationen, es sind auch bei diesen Würmern solche vorhanden. Von den 6 vorliegenden Exemplaren scheint eines

hinten normal zu sein oder eventuell mit einem kurzen Stück weit vorgeschritten regenerierend. 2 andere Exemplare sind in weit vorgeschrittener Regeneration. Ein 4tes Exemplar, ohne Vorderende, hat vorn eine anscheinend ziemlich frische Wunde. Bei einem 5ten Exemplar fehlt hinten eine bedeutende Körperstrecke, hinten ist wohl eine wohl schon etwas geschlossene Wunde vorhanden Das 6te Exemplar ist ein Bruchstück ohne Vorder- und Hinterende, von dem sich nicht sicher sagen lässt, ob es etwa zu dem 5ten Exemplar gehören und in letzterem Falle vielleicht beim Einsammeln der Tiere entstanden sein könnte.— Bezüglich des Vorkommens von Regenerationen mag hier noch eine kleine Anzahl von Individuen dieser Art aus dem Hamburger Zoologischen Museum angeführt sein, die bei Funchal auf Madeira in 7-8 m Tiefe gesammelt wurden. Fast alle diese Exemplare sind unvollständig, u.a. auch vereinzelt am Vorderende und z.T. an der Verstümmelungsstelle mit einem noch kurzen Regenerat versehen. Mir scheint, dass auch da, wo noch kein Regenerat wieder vorhanden ist, die Verstümmelung im Freileben erfolgt ist. Bezüglich der bei dieser Art häufigen Verstümmelungen und Regenerationen verweise ich auch auf meine Ausführungen in meiner Arbeit über Ceylon-Polychaeten (Jenaische Zeitschr. f. Naturwiss. Bd. 62 (N. F. Bd. 55) 1926, p. 436).

Hermodice striata KINB.

Fundort: Bai von Batavia (Java). Insel Edam. 19. XII. 1930. — J. VERWEY.

Von den 12 vorhandenen, nicht ausgewachsenen Exemplaren sind die grössten etwa 50 bis über 60 mm lang. Der erweichte Erhaltungszustand dieser Würmer ist nicht gut genug, um Regenerationen mit voller Sicherheit feststellen zu lassen. Ich meine aber, dass an 6 Exemplaren das Hinterende sich in weit vorgeschrittener Regeneraton befindet. An einem 7ten Exemplar fehlt hinten eine Körperstrecke, von der sich nicht bestimmen lässt, ob sie vor dem Einsammeln der Würmer bereits fehlte.— Die über das Vorkommen dieser Würmer beigefügte Notiz liefert ein weiteres Beispiel zu der bekannten Tatsache, dass die Amphinomiden Tiere und tierische Derivate verzehren.

Fam. Aphroditidae.

Laetmatonice filicornis KINB.

Fundort: Expedition No. 6. Gier No. 24. 7. IX. 1909.

Die wenigen Exemplare dieser Aphroditide — direkt als klein zu bezeichnende Individuen sind nicht vorhanden — sind total bis ca. 50 - 55 mm lang.

Die Zahl der Parapodsegmente beträgt 35, so bei 2 der grössten Tiere, Elytren sind in 15 Paaren vorhanden, so dass das letzte Elytronpaar am 32ten Segment steht. Der Rückenfilz ist vermutlich abgerieben, wie ich das auch bei arktischen Individuen der Art fand. Die Ventralborsten waren so gut wie alle abgebrochen. An 2 Ventralborsten beträgt die Zahl der Kammfiedern weit mehr als 80, am oberen Teile des Fiederkammes lassen sich die Fiedern nicht gut zählen.

Diese Exemplare passen in der hohen Zahl der Kammfiedern der Ventralborsten zu von mir gesehenen arktischen Exemplaren dieser Art, während die arktischen Exemplare 38-40 Parapodsegmente und 17 Elytrenpaare besitzen. Hinwiederum stimmen die vorliegenden Tiere in ihrer Segmentzahl- und Elytronpaarzahl gut zu westeuropäischen Individuen der Art und dem von EHLERS (1908) aus dem ostafrikanischen Meeresgebiet angegebenen Exemplar.

Fam. Polynoidae.

Lepidonotus (Thormora) jukesi BAIRD.

Fundort: Am Dampfponton — ein Jahr zu Wasser —, vor Strasse Boelan (Riouw), Sambo Oh Sempeh. X. 1909. — VORSTER.

Von den 2 Exemplaren dieser circummundan verbreiteten Warmwasserform ist das grössere, vollständig ca. 29 mm lange Tier ein mit Eiern erfülltes Weibchen.

Fam. Phyllodocidae.

Sphaerodoce quadraticeps GR.

Fundort: Molukken und Kei. — ZADELHOFF.

Das einzige Exemplar ist mehr als 300 mm lang.

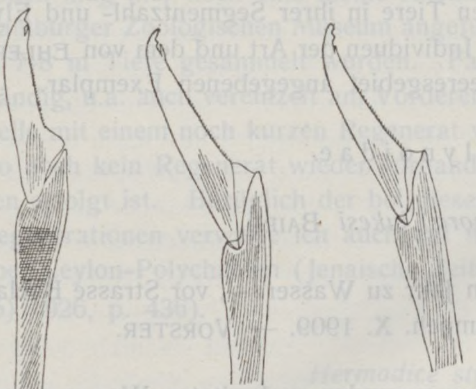
Fam. Hesionidae.

Hesione pantherina RISSO var. *splendida* SAV. (Textfig. 1).

Fundort: Bai von Batavia. Insel Dapoer. 4 VI. 1930. — J. VERWEY.

Das einzige Exemplar ist vollständig ca. 40 mm lang und von hell graugelblicher Grundfärbung. Dorsal findet sich median pro Segment ein grundfarbener mit Ausnahme des 1sten Segments etwa längs-rhombischer oder längs-eiförmiger Fleck, der nach hinten zu am Körper kleiner wird. Der Fleck auf dem 1sten Segment ist der grösste von allen, etwa dreieckig mit

der Basis nach vorn gerichtet. Etwas über den Parapodbasen befindet sich je ein viereckiger weisslicher Fleck und etwas vor diesem ein kleiner dunkelbrauner Fleck. Im übrigen ist der Rücken dicht mit braunen Längsrieselungsstreifen versehen, die vom Beginn der weisslichen supraparapodialen Seitenflecken abwärts mehr oder weniger breit segmental unterbrochen werden. Der oben dunkel graugelbliche, auf seinem vorderen Drittel mit geringer brauner schwacher Zeichnung versehenen Kopf hebt sich so immerhin dunkler ab gegen den hinten an ihn angrenzenden grossen hell grundfarbenen dreieckigen Fleck des 1sten Parapodsegments. Das Analsegment ist grundfarbig.



Textfig. 1. *Hesione pantherina* RISSO var. *splendida* SAV.
a. Obere Borste aus einem mittleren Parapod, Profil. 146×.
b. Mittlere Borste, Desgl. 146×.
c. Untere Borste, Desgl. 146×.

Am Ende der Normalparapodien ist nur eine, oder anders ausgedrückt, die längere obere Papille deutlich, die da, wo die Hauptacicula endigt, entspringt.— Die Borsten stehen zu ca. 20 an den mittleren Parapodien, ihre 2-zähnigen, mit einem unterhalb des Sekundärzahnes entspringenden Scheidenfortsatz versehenen Sicheln sind als kürzer oder als mässig lang zu kennzeichnen. Die oberen Borstensicheln sind etwa 3½ mal, die mittleren etwa 2½-3 mal, die alleruntersten kaum 2½ mal oder noch weniger so lang wie ihre Basalkante. Diese *Hesione* gehört zunächst zu der *H. intertexta* GR. (1878) von den Philippinen, einer Art mit kürzeren Borstensicheln und einer entsprechenden Rückenzeichnung und ausserdem nach meiner Ansicht zu *H. splendida* SAV. Nach GRUBE war die braune Rückenzeichnung seines *intertexta*-Exemplares damals vor einem Jahre sehr deutlich, bleichte aber nach einem Jahre schon aus, während sich nach dem gleichen Autor die Rückenzeichnung der *H. genetta* GR. im Alkohol nicht verlor. *H. splendida* steht der *H. pantherina* RISSO nahe und kann als östliche tropische Form derselben gelten. Bei von mir zum Vergleiche herangezogenen Individuen der *H. pantherina* aus dem Mittelmeer finde ich die Borstensicheln noch etwas länger als bei *H. splendida,* die oberen Sicheln so 4 - 5 mal so lang wie ihre Basis. Noch längere schmale Borstensicheln hat die dorsal braun gezeichnete *H. praetexta* EHL. (1887) Westindiens. Ich nenne das vorliegende Tier *H. pantherina* RISSO var. *splendida* SAV., da es mit *H. pantherina* in Wesentlichen übereinstimmt und durch etwas kürzere Borstensicheln abweicht.

Fam. Syllidae.

Syllis (Typosyllis) exilis GRAV.

Fundort: Verlaten Insel (Krakatau) Brackwasser-See. 19. VII. 1924. — Temp. 31° C. — Salin. 26,4‰. — K. W. DAMMERMAN.

Das einzige Exemplar ist ein weissgelblicher, zeichnungsloser, hinten nicht vollständiger Wurm von ca. 11 mm Länge mit ca. 50 Segmenten. In den hinteren Segmenten sind Eier vorhanden. Die Parapodien mit ihren Lippenbildungen und den langen, zarten, scharf und kurz gegliederten Dorsalcirren entsprechen durchaus dieser Art. Ebenso die zweierlei Borstensicheln, die normalen deutlich 2zähnigen und die kurzen einspitzigen klauenförmigen. Der ausgestülpte Pharynx mit vorderen Solitärzahn ist an seiner Mündung mit 10 weichen Papillen umgeben. Der vorstehende Fundort in schwach salzhaltigem Wasser von dieser tropisch und subtropisch im Indischen und Pazifischen Ozean weit verbreiteten Art ist bemerkenswert.

Bezüglich eines marinen Exemplares dieser Syllide verweise ich auf meine Besprechung der *Odontosyllis arenicolor* GR.

Syllis (Typosyllis) krohni EHL.

Fundort: Insel Onrust bei Batavia. Auf dem Korallenriff. 6 - 7. VIII. 1931. — L. VAN LUMMEL.

Das einzige Exemplar ist agam und hinten unvollständig, ca. 12 mm lang mit ca. 74 Segmenten und von gelblichweisser Grundfärbung. Bis zum ca. 35ten - 40ten Borstensegment ist dorsal eine dunkelbraune, nach hinten zu immer blasser werdende segmentale Querstreifenzeichnung vorhanden, die bei vollster Ausbildung folgendermassen beschaffen ist. Quer über die Segmentmitte zieht ein lateral auf die Basis der Dorsalcirren hinaufgreifender Querstreif, der median unterbrochen ist in nicht ganz der Breite von Pharynx und Muskelmagen. Auf der vorderen Parapodgrenze verläuft ferner ein ununterbrochener Querstreif, der seitwärts nicht bis an die Parapodbasen heranreicht. Ein 3ter Querstreif verläuft hinter dem Medianquerstreif, ist median eher noch breiter unterbrochen als letzterer, erreicht aber lateral die Dorsalcirrenbasis nicht. Der auch mit Stirnaugen versehene Kopf ist oben dunkelbraun gefleckt, die Palpen sind medial-proximal dunkelbraun berandet. Die vorderen Dorsalcirren tragen braune Flecken, häufig so auf jedem 5ten Ringel; braungefleckt sind auch die Fühler.

Die Dorsalcirren zeigen die starke Alternation in ihrer Länge im Sinne der *S. krohni,* sind kräftig; die langen übertreffen noch am Mittelkörper an Länge etwas die Körperbreite und sind bis ca. 2 mal so dick wie die kurzen. In der Pharynx-Magenregion haben die langen Dorsalcirren mindestens 40, die kurzen etwa 24 Glieder, von denen die mittleren doppelt so breit wie lang sind. Alle Cirren sind fadenförmig.

Der eingezogene Pharynx — sein Solitärzahn liegt ganz vorn in der Mündung—, ist rostbraun, beginnt im 4ten und reicht bis ins 14te, der Muskelmagen bis ins 28te Borstensegment nach hinten.— Die Parapodien haben 2 eiförmige Lippen, von denen die vordere, oben am Parapodende entspringende länger und schmäler als die hintere ist, welche etwas tiefer, hart an der Acicula entspringt. Die Sicheln der am Vorderkörper zu ca. 10, am Mittelkörper zu ca. 8 pro Parapod vorhandenen komplexen Borsten sind kurz, am Vorderkörper länger als am Mittelkörper. Die Sicheln vom Vorderkörper sind schwach gebogen, am Ende deutlich 2zähnig im Sinne von *S. variegata* GR.; zu oberst im Borstenbündel finden sich etwa 3 Borsten, deren Sicheln kaum gebogen und etwa doppelt so lang sind wie die Sicheln der untersten Borsten. Die recht kurzen Sicheln vom Mittelkörper sind wenig verschieden an Länge im Borstenbündel und besitzen einen sekundären Zahn, der wie an den Sicheln vom Vorderkörper nahe an der Sichelspitze steht, aber schwächer als dort entwickelt und öfter kaum zu erkennen ist. Dieses *Syllis*-Exemplar zeigt so geringfügige Abweichungen von der europäischen *S. krohni,* die bereits aus dem Indischen Ozean angegeben wurde, dass ich sie nicht von derselben trennen kann.

Opisthosyllis australis AUG.

Fundort: Insel Onrust bei Batavia. — Auf dem Korallenriff. 6-7. VIII. 1931. — L. VAN LUMMEL.

2 mittelgrosse Exemplare, von denen das eine wenig grössere ca. 16 mm lang ist, vertreten diese Art und tragen beide hinten eine differenzierte Sexualknospe. — Die Charaktere dieser Würmer passen vollkommen zu *Op. australis,* so u.a. in dem Vorhandensein von Stirnaugen, des Nuchallappens, in der Form der Borstensicheln. Der von einem hyalinen Hofe umgebene Pharynxzahn ist etwa um 1½ Segmente vom Hinterende des rostbräunlichen Pharynx entfernt. Hautpapillen sind gewiss vorhanden, doch schlecht zu erkennen infolge (?) der Formolkonservierung der Würmer.

Am Kopfsegment der Sexualknospen sind braune Augen schon erkennbar. Die eine Knospe, dorsal bräunlich gepunktet, ist ein Weibchen mit Eiern und enthält ca. 18 Segmente, die andere Knospe enthält ca. 29 Segmente.

Odontosyllis gibba CLAP.

Fundort: Insel Onrust bei Batavia. Pelagisch am Rande des Korallenriffs. Erscheinungszeit einige Tage später als bei *Odontosyllis hyalina*. Leuchtend. 3. VIII. 1931. — L. VAN LUMMEL.

Von diesen epitoken geschlechtsreifen Würmern sind etwa ein Dutzend Individuen mit Kopf vorhanden, z.T. nur kurze Vorderenden, vereinzelte Tiere sind hinten nahezu vollständig. Das ungefähr grösste Exemplar, dem hinten nur ein kleines Stück an seiner Vollständigkeit fehlt, ist ca. 11 mm lang, mit ca. 56 Segmenten, es dürfte total mindestens 60 Segmente gehabt haben. Die Färbung ist hell graulich-weiss mit einer Spur von gelblich, ohne anderweitige Zeichnung. Pharynx und Magen schimmern rostbräunlich nach aussen durch. Diese Würmer haben die allgemeinen Charaktere der europäischen *Od. gibba* und stimmen so gut mit dieser überein, dass ich sie zuordne. Es sein noch folgendes über die Tiere bemerkt. Fühler, Buccal- und Dorsalcirren sind sehr schwach keulenförmig und gegen ihre Spitze wieder ein wenig verjüngt und weisen höchstens eine undeutliche Ringelung auf. Stirnaugen sind nicht vorhanden, die rostbraunen Hauptaugen sind nicht auffällig vergrössert im epitokalen Sinne, haben Linsen, die Augen jeder Kopfhälfte berühren einander fast. Die Palpen sind nach unten geschlagen. Der halbmondförmige Nuchallappen ist wie bei der europäischen Art beschaffen. Die kurzen Sicheln der komplexen Borsten sind einspitzig. Pharynx und der etwa 35 - 40 Querreihen enthaltende Muskelmagen liegen bei mehreren Individuen im 4ten und 5ten resp. 6 - 9ten Borstensegment.

Epitokale Schwimmborsten treten vom 11ten oder 12ten Borstensegment an auf. Geschlechtsprodukte finden sich vom Ende des Muskelmagens an; wenn solche noch vorhanden waren, erwiesen sie sich als Sperma.

Die Zahnquerreihe im Eingange des Pharynx enthält 6 oder 7 Zähne in der Weise, dass eine mittlere Reihe von 4 oder 5 grossen Zähnen jederseits von einem kleineren Zahn flankiert wird nach der Formel 1 + 4 oder 5 + 1. Nach SAINT - JOSEPH (1887) beginnen bei epitoken *Od. gibba* aus dem Französischen Meeresgebiet die Schwimmborsten am 7ten Segment beim Männchen, am 2ten Segment hinter dem Muskelmagen beim Weibchen. Der Beginn der Schwimmborsten beim Weibchen würde danach zu meinem Befunde an den Onrust-Exemplaren passen, wiewohl ich nicht feststellen konnte, dass sich auch Weibchen unter diesen Exemplaren befanden. Ich nehme an, dass ich nur männliche Individuen vor mir hatte.

Ich verdanke die Möglichkeit, diese *Odontosyllis*-Art wie die *Od. hyalina* und mehrere andere Polychaeten von Onrust untersuchen zu können, der grossen Liebenswürdigkeit von Fräulein Dr. L. VAN LUMMEL, welche auf meine Bitte zwecks Nachforschung nach der agamen Form von *Od. hyalina* mir die in Frage stehenden Würmer zusandte. Die agame Form von *Od. hyalina* befand sich allerdings leider nicht dabei.

Diese indo-malayischen *Od. gibba* bieten kaum eine Handhabe, sie zu einer Varietät der atlantisch-mediterranen *Od. gibba* zu erheben, ich sehe daher einstweilen von einer besonderen Benennung derselben ab.

Eine briefliche Mitteilung von Fräulein Dr. VAN LUMMEL über diese *Od. gibba*-Tiere lautet folgendermassen:

„Im Glase IV sind Exemplare einer anderen Art; sie kommen einige Tage später zum Vorschein wie die erstgenannten (nämlich die *Od. hyalina)*, um 7 h 30 nachm. Sie erscheinen am Rande des Korallenriffs, schwimmen mit Vorliebe gegen den schwachen hier längs dem Riff fliessenden Strom und hinterlassen eine ± 7 m lange weissblau leuchtende Spur. Eier habe ich von dieser Form nie gefunden".

Odontosyllis fulgurans CLAP. var. *arenicolor* GR.

Odontosyllis dugesiana — CLAPARÈDE 1864.
„ *arenicolor* — GRUBE 1878.
„ *hyalina* — GRUBE 1878.

Fundort: Bai von Batavia. Insel Onrust. Korallenriff.
3. V. 1931. Abends leuchtend. — STEINFURTH
Bai von Batavia. Insel Onrust. 31 VIII. 1931.
Korallenriff. Pelagisch. Leuchtend. — VAN LUMMEL.

Epitoke, pelagisch gefischte Individuen dieser *Odontosyllis* — von GRUBE 1878 als *Od. hyalina* beschrieben —, erhielt ich in kleinerer Zahl zuerst durch Herrn STEINFURTH, später in grösserer Zahl durch Fräulein Dr. L. VAN LUMMEL.

Alle Exemplare sind mehr oder weniger zerbrochen, ein Tier mit noch 46 erhaltenen Segmenten ist ca. 5,5 mm lang. Die Färbung, von der sich die riesigen dunklen Kopfaugen auffallend abheben, ist weisslich farblos, der leere Darm schimmert ganz schwach bräunlich nach aussen durch.

Die Einzelheiten an diesen Würmern passen gut zu der europäisch-afrikanischen *Od. fulgurans* CLAP., wenn man von den Augen absieht. Die Fühler etc., Dorsalcirren sind erfüllt mit lichtbrechenden körnigen Massen. Die Schwimmborsten fand ich bei etlichen untersuchten Tieren meist am 33ten in wenigen Fällen am 34ten Borstensegment beginnend.— Die gewöhnlichen Sichelborsten, am Vorderkörper etwa zu 10, in der Gegend des 45ten Segments etwa zu 5 pro Parapod auftretend, haben überall kurze 2zähnige Sicheln, welche in ihrer Form zu den Abbildungen passen, welche LANGERHANS (1879) von der *Od. dugesiana* von Madeira geliefert hat. Am Vorderkörper sind die Sicheln länger als weiter hinten, und ihr sekundärer Zahn ist klein und ziemlich weit von der Sichelspitze entfernt. Die kurzen Sicheln am Mittel-und Hinterkörper sind etwas *Autolytus*-artig, der Sekundärzahn ist gross und kräftig und entspringt nahe der Sichelspitze. Da die Sichelbasis an ihrem der Sichelschneide zugekehrten Ende zahnartig vorgezogen ist, sieht

es so aus, als wenn 3 Zähne von der Sichelschneide entsprängen, von denen der Endzahn, der länger als der Sekundärzahn ist, der längste ist.

Der Pharynx reicht im wie stets eingezogenen Zustande z.B. bis ans 7te oder 8te, der Muskelmagen, mit etwa 60 - 65 Querreihen, bis ans 20te Borstensegment nach hinten. Die Zähne im Pharynxeingang, zu 6 oder 7 vorhanden, verhalten sich ganz wie bei *Od. fulgurans* und *dugesiana.*

Unter dem vorliegenden Material von meist mit extrem vergrösserten Kopfaugen versehenen Individuen finden sich auch Tiere mit merklich kleineren Augen, bei denen die Augenpaare jeder Kopfhälfte breit voneinander getrennt sind. Diese Tiere hatten z.T. Schwimmborsten, z.T. waren sie vor dem sonst beobachteten Beginn der Schwimmborsten abgebrochen. Vereinzelte Exemplare enthielten Eier und zwar einmal ein ca. 6,5 mm langes Hinterende mit ca. 61 Segmenten, bei welchem an den etwa 10 ersten Segmenten Pubertätsborsten und Eier mit Ausnahme der ca. 24 letzten Segmente vorhanden sind. Ferner finden sich bei einem von 2 Individuen mit kleineren Augen, bei denen Pubertätsborsten an den 34 oder 35 ersten Segmenten zu fehlen scheinen, Eier vom ca. 18ten Segment an. Ob etwa die Pubertätsborsten bei weiblichen Individuen um ganz wenige Segmente später beginnen als bei den Männchen, habe ich nicht genau ermitteln können, lasse daher diese Frage noch offen. Möglich ist andererseits, dass bei den Weibchen sich die Augen nicht so extrem gross epitokal entwickeln wie bei den Männchen, da wohl kaum anzunehmen ist, dass bei den pelagischen, vollreifen, mit Eiern und Pubertätsborsten versehenen Weibchen während ihrer pelagischen Periode die Augen sich noch zu der Grösse der Augen der Mehrzahl der von mir gesehenen Individuen entwickeln sollten.

An von der Ventralseite her mikroskopisch untersuchten Tieren erkennt man medial an der Basis der Parapodien eine rundliche, dunklere Stelle mit einem zentralen hellen Fleckchen, das, wie ich annehme, die Ausmündungsöffnung des Segmentalorgans ist. Das Segmentalorgan selbst vermute ich in einer im Inneren der Segmente liegenden Masse vor mir zu haben.

Ueber das Originalmaterial der *Od. hyalina* habe ich mich bereits (1912) im Anschluss an die südwest-australische *Od. detecta* geäussert und kann hierzu nach der Untersuchung des frischen Materials noch etwas ergänzen. Das Originalmaterial befindet sich in den 2 Sammlungsgläsern F. 1975 und F. 1976 im Berliner Zoologischen Museum. Das Glas F. 1975 mit der Fundortsnotiz „Mindanao und Placer", enthält wieder 3 Glasröhrchen mit *Od. hyalina.* Von den wenigen vollständig erhaltenen Individuen in diesem meist zerbrochenen Material sind die 2 grössten ca. 17 und 22 mm lang. Im Glase F. 1976 mit der Fundortsnotiz „Singapore (Semper leg.)" sind auch 3 Glasröhrchen enthalten mit insgesamt wenigen Individuen von *Od. hyalina.* Bei geeigneter Erhaltung ist ein Nuchallappen deutlich erkennbar. Die Neigung, in kleine Segmentkomplexe zu zerfallen, zeigt sich ebenfalls bei der später noch zu besprechenden *Od. arenicolor* GR. (1878). Die von GRUBE in seiner

Beschreibung angegebene und an Tieren von Mindanao und Placer noch jetzt sichtbare schwarze Färbung der Segmentalorgane finde ich niemals bei dem Material von Onrust, sie mag auf ein bestimmtes Konservierungsmittel zurückführbar sein. Ebensowenig habe ich an den Onrust-Exemplaren die an ganz wenigen Individuen von Mindanao und Placer von mir schon früher (1912) erwähnte und auch jetzt wieder gesehene lange Penis-artige Segmentalpapille gefunden. Ich vermute, dass sie einen unnormalen Zustand darstellt und vielleicht irgendwie durch Druck und daraus resultierende Vorstülpung der Endstrecke der Segmentalorgane entstanden sein kann.

Die Biologie dieser leuchtenden *Odontosyllis*-Form bedarf noch weiterer Nachforschung an den Orten, wo diese Würmer leben. Die folgenden Angaben über die epitoken Individuen verdanke ich der Liebenswürdigkeit von Fräulein Dr. VAN LUMMEL.

„Im Glase 2 sind noch viele Exemplare von *Odontosyllis hyalina,* gefangen am 31. VII. 31. Zur Aufklärung diene Ihnen noch, dass die epitoke Formen nach meinen fünfmonatigen Untersuchungen regelmässig 2 Tage nach Vollmond an die Oberfläche des Wassers kommen von 6 h 45 bis 7 h nachm. Am 2ten Tage nach ihrem Erscheinen sind sie am zahlreichsten und verschwinden wieder am 3ten Tage nach ihrem Erscheinen. Ich habe die epitoke Form in grossen Flaschen einen Monat am Leben erhalten, und gleichfalls deren Larven. Exemplare, die ich nach mehrtägigem Aufenthalt in diesen Flaschen in das hiesige Seewasseraquarium überführte, schwammen direkt nach den Korallen hin und verschwanden in diesen. Ein Leuchten habe ich nicht wieder wahrnehmen können. Beim Erscheinen dieser leuchtenden Würmer geben diese einen grün-leuchtenden Schleim ab in Spiralen, kommen nur über den untiefen Korallen vor und sind in grosser Anzahl vorhanden. Alle Würmer sind deutlich negativ phototropisch".

Bemerkungen über *Odontosyllis arenicolor* GR. und die agame Form von *Odontosyllis hyalina.*

Wie ich schon weiter vorn erwähnte, war es mir leider nicht möglich bisher, von Onrust die agame Form zu der epitoken *Od. hylina* zu erlangen. Ich bin aber inzwischen zu der Ueberzeugung gelangt, dass die von GRUBE (1878) vor *Od. hyalina* beschriebene *Od. arenicolor* die agame Form der ersteren ist. Dank der Freundlichkeit von Herrn Prof. F. PAX in Breslau konnte ich das im Breslauer Zoologischen Museum noch vorhandene *arenicolor*-Material GRUBE's nachprüfen.

Das betreffende Sammlungsglas trägt aussen die Fundortsangabe „Semper 79. (Camiguin, Philippinen?)" und enthält 2 Glasröhrchen mit je einem Wurm.

a) Der Wurm, neben dem ein Zettel mit der Aufschrift „Nr. 79" liegt, ist eine agame Syllide von ca. 37 mm Länge, erweicht, hinten nahezu vollständig, keine *Odontosyllis* und scheidet daher für die weitere Betrachtung hier aus. Es ist eine *Typosyllis,* mit deren Charakteren, mit vorderem Solitärzahn, kurz gegliederten Cirren u.s.w., und passt als Art zu *S. exilis* GRAV., hat u.a. dimorphe Borstensicheln dieser Art, die am Hinterkörper besonders kurz und sehr stark, sichelartig gekrümmt sind. Durch diese Feststellung der *S. exilis* im Gebiete der Philippinen hat sich meine frühere Vermutung, dass die philippinische *S. solida* GR. (1878) die gleiche Art sein könne, noch verstärkt.

b) Der Wurm, neben dem ein gedunkelter, unleserlicher Zettel liegt, ist ein agames vollständiges Tier von ca. 13 mm Länge, mit ca. 80 Borstensegmenten, weich und gedehnt, dunkelbraun. Er ist eine *Odontosyllis* nach allen erkennbaren Charakteren; die Pharynxbezahnung lässt sich auch bei stärkster Aufhellung nicht erkennen. Ich halte diesen Wurm, der die Neigung zeigt, in Segmentkomplexe von meist 4 Segmenten aufzubrechen, für die *Od. arenicolor* und ausserdem für die agame Form der *Od. hyalina.* Der Wurm ist beschaffen wie ein kleineres Exemplar von *Od. fulgurans* sive *dugesiana,* hat 2 Paar ziemlich grosse Kopfaugen und einen gut entwickelten Nuchallappen. Die Borstensicheln haben die gleiche Form einerseits wie bei *Od. hyalina* andererseits wie bei *Od. dugesiana* u.s.w. — *Od. hyalina* muss nach meiner Auffassung als epitoke Form zu der agamen *Od. arenicolor* gehören, welche wiederum von der agamen *Od. fulgurans* nicht zu trennen ist. Ich halte es für angebracht, *Od. arenicolor* als kleinere biologische Varietät, soweit die epitoke Form in Frage kommt, von *Od. fulgurans* zu sondern.

GRUBE gibt als Fundort „Bohol", nicht Camiguin an und beschreibt an erster Stelle ein 8 mm langes Tier, das mit dem hier unter b) skizzierten Wurm identisch sein mag. An zweiter Stelle wird ein 30 mm langes Tier aufgeführt, das mit der unter a) hier besprochenen *S. exilis* identisch sein kann.

Für die gleiche Art wie *Od. fulgurans* halte ich die europäisch-afrikanische *Od. dugesiana* CLAP. (1864), von CLAPARÈDE hinter *Od. fulgurans* beschrieben. LANGERHANS, der diese beiden Arten von Madeira (1879) anführt und zwar *Od. dugesiana* an 2ter Stelle, bemerkt von den Borsten der *Od. dugesiana:* „Borsten überall zusammengesetzt, mit kurzem 2zähnigem Endglied, dessen 2ter Zahn dem Ende bald näher bald ferner steht wie übrigens auch bei *Od. fulgurans*". Seine Borstenfiguren von *Od. dugesiana* entsprechen den Borsten von *Od. arenicolor* und *hyalina.* Pubertätsborsten sind nach dem gleichen Autor bei *Od. dugesiana* vom 32ten Segment an entwickelt, was ja fast aufs Haar mit *Od. hyalina* übereinstimmt. Bei *Od. fulgurans* begannen nach LANGERHANS bei 2 kleineren Männchen die Pubertätsborsten schon am 17ten resp. 20ten Segment.

Ueber die von Fräulein VAN LUMMEL von den *hyalina*-Tieren von Onrust gezüchteten und mir mit zugesandten Larven vom 15. VIII. 31 ist wenig zu sagen. Sie haben eine ungegliederte vordere, vorn breit eiförmig abgerundete Körperhälfte und eine 3 segmentige, nach hinten kegelförmig verjüngte hintere Körperhälfte, an welcher von sonstigen Organen wie Parapodien und Borsten noch nichts entwickelt ist.

MONRO führt (1931) von der Barrier Reef - Expedition 2 epitoke *hyalina*-Exemplare vom 3. X. 28 von Low Isles an, mit der Bemerkung u.a., dass sie leuchtend nach Einbruch der Dunkelheit in der Lagune gefangen wurden.

Als Nachtrag gebe ich noch den Inhalt eines 2ten, vom 28. II. 32 aus Onrust datierten, von Fräulein VAN LUMMEL im März 1932 mir zugegangenen Briefes wieder, welcher Mitteilungen über gewisse, auf meinen Vorschlag hin unternommene Versuche mit *Odontosyllis hyalina* enthält, die sich auf die Rückbildung der epitoken Form in die agame Form beziehen: „Zweimal habe ich nun diesen Versuch gemacht mit *Odontosyllis hyalina* Gr. Ich konnte bei beiden Versuchen einige Exemplare vier Wochen lang am Leben erhalten, doch nicht mit einem so sicheren Ergebnis, um eine bestimmte Behauptung auszusprechen. Bei dem 1sten Versuch hatte ich einen mit kleinen Algen bewachsenen Stein in den Glasbehälter getan zwecks Lieferung von etwaiger Nahrung für die Würmer, doch stellte sich hierbei nach einiger Zeit heraus, dass in diesem Stein viele Larven und andere Würmer waren, so dass ich aus diesem Grunde wenig über die noch vorhandenen *Odontosyllis*-Exemplare sagen kann. — Bei meinem 2ten Versuch habe ich ungefähr 20 *Odontosyllis hyalina* in ein mit filtriertem Wasser gefülltes Glasaquarium getan und dieses bei diffusem Licht ununterbrochen mit Druckluft durchlüftet. Jede Woche habe ich die Tiere untersucht und gefunden, dass die Augen viel kleiner wurden, während die Tiere die Borsten behielten, die jedoch beim Kriechen der Tiere dem Körper angedruckt getragen wurden. Die Tiere schwammen nicht in dem Behälter herum, sondern krochen am Bodem und den Seitenwänden umher. Nachdem ich jede Woche 2 oder 3 Tiere zwecks Untersuchung herausgenommen hatte, lebten nach vier Wochen noch 5 oder 6 Tiere; ein beschädigtes Exemplar regenerierte im Behälter. Weitere Versuche werde ich machen in einem Glasaquarium mit durchströmendem Wasser oder auf andere Weise, um so die Tiere besser am Leben zu erhalten und herauszubekommen zu suchen, wie lange die ungeschlechtliche Periode dauert. Ob es mir gelingen wird, weiss ich nicht, da *Diadema setosum* und *Echinotrix diadema,* 2 hier häufig vorkommende Echinodermen, die ich in dem hiesigen Aquarium lange Zeit lebend erhalten habe, nicht geschlechtsreif wurden, was möglicherweise auch mit den Odontosyllis der Fall sein kann.— Ich kann Ihnen dann noch mitteilen, dass ich jetzt zwölfmal das Schwärmen der *Odontosyllis* mit vierwöchigen Intervallen beobachtet habe. Das Schwärmen ist immer ein grossartig anzusehendes Schauspiel. Das Schwärmen, das bei nördlicher Deklination der Some um 6 h 45 - 7 h abends stattfand, hat sich

aber langsam auf 7 h 15 - 7 h 30 in seinem Auftreten verschoben, was sicherlich der zunehmenden Tageslänge zuzuschreiben ist". Nach diesen Mitteilungen besteht für mich kaum noch ein Zweifel, dass *Odontosyllis fulgurans* CLAP. var. *arenicolor* GR. als Einzeltier zum mindesten mehr als eine Schwärmzeit hat, indem nach einem Schwärmen im Zusammenhange mit der bodensässigen Lebensweise die Augen wieder auf ihre normale Grösse verkleinert und die Schwimmborsten abgeworfen werden.

Fam. Nereidae.

Nereis jacksoni KINB.

Fundort: Insel Onrust bei Batavia. Korallenriff. 6-7. VII. 1931. — L. VAN LUMMEL.

Die ganz wenigen Tiere dieser Art sind kleine schlanke agame, hinten unvollständige Würmer. Das hinten am weitgehendsten erhaltene Exemplar, dem an seiner Vollständigkeit hinten offenbar nur wenige Segmente fehlen, ist mit noch ca. 53 Parapodsegmenten ca. 17 mm lang.— Diese zeichnungslosen Tiere passen in ihren äusseren Charakteren gut zu *N. jacksoni.* Der Kopf ist vorn median nicht eingeschnitten, die Buccalcirren sind kurz oder ziemlich kurz. Die Dorsalcirren überragen erheblich die obere Dorsallingula, diese Lingula ist noch deutlich entwickelt an den letzten Parapodien des 17 mm langen Tieres.— Ungefähr an den 35 letzten Segmenten des letztgenannten Tieres treten pro Parapod 1 oder 2 der starken dorsalen 2zähnigen homogomphen, für diese Art charakteristischen Sichelborsten auf, die durch ihre Stärke und bräunliche Färbung auffallen. An den kurzen und kräftigen Sicheln ist bei günstiger Erhaltung und Beobachtungslage noch ein unterstes 3tes Zähnchen erkennbar.

Da bei allen 3 Exemplaren der Rüssel eingezogen ist, lässt sich die Paragnathenausstattung nicht ausreichend sicher feststellen. Am aufgeschnittenen Rüssel des einen Tieres sind meines Erachtens maxillare und orale Paragnathen vorhanden. Am Oralring ist z.B. VII + VIII wohl sicher eine einfache Querreihe von Paragnathen, VI eine kleine Gruppe von solchen. Selbst wenn aber orale Paragnathen bei diesen Würmern nicht entwickelt wären, müsste ich sie nach ihren übrigen Charakteren doch als ceratonereide Form zu *N. jacksoni* stellen.

Nereis (Perinereis) perspicillata GR.

Fundort: Insel Onrust bei Batavia. Korallenriff. 6.-7. VIII. 1931. L. VAN LUMMEL.

Das eine Exemplar ist agam und total mit ca. 69 Borstensegmenten ca. 24 mm lang. Der Kopf ist median zwischen den Augen mit einer dunkel-

braunen Längsbrille gezeichnet, deren vorderes Auge grösser als das hintere ist. Das Buccalsegment trägt dorsal eine matt bräunliche, nicht scharf ausgeprägte Querbrille. Die sonstigen Segmente des Vorderkörpers sind dorsal unterbrochen matt bräunlich, am deutlichsten in der Mitte, und an ihrem Hinterrande jederseits, etwa mitten zwischen der Längsmediane und den Körperseitenkanten, mit einem schwarzbraunen, kleinen quergezogenen Fleck versehen.— An den Parapodien des Hinterkörpers ist die obere Dorsallingula mit ihrem Dorsalcirrus ganz unbedeutend lateral vorgezogen, wobei keineswegs ein deutliches Fähnchen gebildet wird.— Am eingezogenen Rüssel, dessen Kiefer dunkelgelb mit braunen Spitzen sind, lassen sich die Paragnathen nicht genauer in allen Gruppen ermitteln, in Gruppe VI steht ein querer kompresser Paragnath.

Ein 2tes Exemplar, zusammen mit dem 1sten auf dem Riff gefunden, ist ein nahezu voll epitokes Männchen von ca. 11 mm Länge, hinten scheinen ein paar Segmente zu fehlen. Die dorsale Färbung und Zeichnung von Kopf und Vorderkörper ist wie bei dem agamen Tier, z.T. blasser als dort, deutlich sind die 2 dunklen Querfleckchen am Hinterrande der Segmente. Die Augen sind stark vergrössert, die Palpen nach abwärts gerichtet. Die ersten 7 Dorsalcirren sind in ihrer Form modifiziert. Am Mittel- und Hinterkörper sind die Parapodbasen oben mit kleinem dunklem Querfleckchen versehen. Die Dorsalcirren der epitokalen Region, z.B. aus der Mitte derselben, tragen an ihrer Ventralkante Vorwölbungen, von denen etwa 5 obere deutlicher und im Extrem etwa halbkreisförmig oder halbkreisförmig- dreieckig vorragen. An den epitokalen Parapodien sind die üblichen Lappenbildungen und z.B. an mittleren solchen Parapodien allein komplexe Schwimmborsten entwickelt. Wie bei dem von MONRO (1931) erwähnten epitoken Männchen von Singapore beginnt die epitokale (2te) Region mit dem 15ten Parapodsegment.

Diese *Perinereis*-Art steht der *N. cultrifera* GR. und *N. camiguina* GR. nahe, ich behalte sie einstweilen als Art bei. Eher könnte man daran denken, vielleicht *N. camiguina* mit *N. cultrifera* zu vereinigen.

Nereis (Platynereis) dumerili AUD. & EDW.

Fundort: Insel Onrust bei Batavia. Korallenriff. 6.-7. VIII. 1931. — L. VAN LUMMEL. Verlaten Insel (Krakatau), Brackwasser-See. 19. VII. 1924. — Temp. 31° C. — Salin. 26,4 ‰. — K. W. DAMMERMAN.

Die in geringer Zahl vorliegenden Tiere von Onrust sind meist agam, eines der grössten agamen Exemplare ist ca. 22 mm lang, eines hat etwas vergrösserte Augen. Ausserdem ist ein sub-epitokes Männchen vorhanden von total ca. 18 mm Länge, mit bereits stark vergrösserten Augen und etwas modifizierten Parapodien, doch mit noch vollkommen agamaler Borstentracht.

In mässiger Zahl sind von Verlaten Insel agame Individuen vorhanden von einer Totallänge im Maximun von ca. 38 und einer Minimallänge von etwa 14 mm. Ausserdem liegt ein sub-epitokes Männchen vor von total ca. 31 mm Länge. Dieses Männchen ist im Ganzen noch agam, aber mehr abgeplattet als die rein agamen Individuen. Die Augen sind deutlich grösser als normal, die Dorsalcirren der vordersten Parapodien in ihrer Form geringfügig verändert.

Der Fundort Verlaten Insel ist ein Beitrag zur Anpassung dieser Art an schwach salzhaltiges Wasser; wahrscheinlich pflanzt sie sich dort auch fort.

Lycastis ranauënsis FEUERB.

Fundort: W. Java. Buitenzorg. Teich im Botanischen Garten. VI. 1927, A.G. VORSTMAN.

Von dieser nur in wenigen Exemplaren mir vorliegenden, in Süsswasser gesammelten *Lycastis* sind die grössten Individuen total ca. 90 — 100 mm lang. Kopfaugen sind nicht erkennbar und fehlen wohl normalerweise. Ungefähr in der hinteren Hälfte der Körperlänge sind die Parapodien mit vaskularisierten Dorsalfähnchen versehen.

Die Borsten habe ich an einem ca. 80 mm langen, mit Massen von Eiern erfüllten Wurm genauer untersucht. An einer erheblichen Zahl von Segmenten vom vorderen Körperende an gerechnet ist eine dorsale Grätenborste pro Parapod vorhanden, eine solche kann z.B. noch in der Gegend des 57ten bis 59ten Parapods auftreten. Am ventralen Parapodast finden sich in dieser Körpergegend sub-acicular 3 Grätenborsten mit Gräten, welche mit etwas gröberer Zähnelung versehen sind als die Gräten der supraacicularen Grätenborsten. Unterhalb der Grätenborsten stehen sub-acicular 6 Sichelborsten mit Sicheln der gewöhnlichen kurzen Form, keine Sichel hat die modifizierte Form mit starker längerer Zähnelung. Supra-acicular stehen hier bis zu 5 Grätenborsten und bis zu 3 Sichelborsten mit gewöhnlichen kurzen Sicheln.

An Parapodien aus dem hintersten Körperlängenviertel finden sich folgende Ventralborsten. Supra-acicular 3 Grätenborsten und 1 Sichelborste; sub-acicular 6 Sichelborsten, von denen die 5 unteren gewöhnliche kurze Sicheln haben, während die oberste eine lange, mehr grätenartige Sichel trägt mit grober Zähnelung. Die Zähne dieser langen Sichel sind viel gröber und länger, besonders so am unteren Teile der Sichel, als die gleichmässig feinen und kurzen Zähnchen der supra-acicularen Gräten. Nach ihrer Länge und grätenartig feinen Endstrecke würde man die modifizierte sub-aciculare Sichel vielleicht richtiger noch als modifizierte Gräte klassifizieren. An einer mittleren sub-acicularen Sichelborste mit kurzer Sichel zeigt sich gleichfalls die starke grobe Zähnelung an der Sichel, während die Sicheln der übrigen kurzsicheligen sub-acicularen Sichelborsten gleichmässig und fein gezähnt sind

wie die kurze Sichel der supra-acicularen Sichelborste. An 3 auf einander folgenden Parapodien sah ich sub-acicular die obere lange und die mittlere kurze Sichel, an welchen beiden die Zähne von unten nach oben schnell an Länge abnehmen.

Diese *Lycastis*-Tiere sind identisch mit der *L. ranauënsis* FEUERB. aus Sumatra, von welcher ich Exemplare selbst vergleichen konnte, ohne dass bisher eine Veröffentlichung über diese Art vorliegt zur Zeit der Abfassung meines Manuskripts. *)

HORST hat (1918. p. 247) am Ende seiner Beschreibung der *L. meraukensis* von Neu-Guinea noch eine andere *Lycastis* und zwar von Buitenzorg kurz erwähnt unter dem Namen *L. hawaiiensis* H.P. JOHNS. Nach HORST sind die Tiere von Buitenzorg viel schlanker als die *L. meraukensis (L. meraukensis* ist eine differente Art) und entbehren der Dorsalborsten. Ich vermute, dass die Dorsalborsten von HORST übersehen wurden und dass die Buitenzorger Tiere identisch sind mit der von mir hier erörterten *L. ranauënsis* von Buitenzorg. Dagegen glaube ich nicht, dass HORST'S *L. ranauënss* von Buitenzorg zu H.P. JOHNSON'S Originalart von Hawaii gehört. *L. hawaiiensis* hat Kopfaugen, und bei Besprechung der Borsten wird das Auftreten einer subacicularen kurzen und langen modifizierten, lang und stark gezähnten Sichel nicht erwähnt. Uebrigens sind Borsten einzeln bei stärkerer Vergrösserung nicht abgebildet.

Eine 2te Süsswasser-Nereide, die *Lycastopsis catarractarum* FEUERB., von Prof. FEUERBORN aus Sumatra und Java mitgebracht, scheint in Niederländisch-Indien eine ausgedehntere Verbreitung zu haben. Sie wurde von Prof. W. HARMS im Jahre 1929 auch auf der Insel Ambon gesammelt. Die Tiere, von denen ich 2 reife Exemplare untersucht habe, lebten (der Name des Fundorts war nicht genau lesbar) unter Kokospalmenblättern in der Spreite am Stamme, zusammen mit Oligochaeten, Myriopoden, *Peripatus* etc.

Fam. Eunicidae.

Eunice (Eriphyle) aphroditois PALL.

Fundort: Biliton. An der ein Jahr zu Wasser befindlichen Gasboje innen vor Tj. Pandan, 30. IX. 09. — VORSTER.
Am Dampfponton, ein Jahr zu Wasser. Vor Strasse Boelan (Riouw), Sambo Oh Sempeh. X. 1909. — VORSTER.

Diese in geringer Zahl vorliegenden Eunicen sind in verschiedener Länge klein im Verhältnis zu der von dieser Art erreichten Grösse. Das einzige Tier

*) Die Veröffentlichung ist inzwischen erfolgt.

von Sambo Oh Sempeh ist total ca. 183 mm lang und ca. 8 - 8,5 mm maximalbreit ohne Parapodien; unter den Tieren von Tj. Pandan befinden sich Exemplare von ca. 9 mm Maximalbreite. Die Palpenteilung ist meist deutlich, die Fühler sind ungegliedert, höchstens schwach geringelt. Bei 3 grösseren Individuen beginnen die Kiemen am 5ten und 2mal am 6ten Parapod.

Eunice antennata SAV.

Fundort: Ostküste von Banka. An Bojen. II. 1911. — VORSTER.
Am Dampfponton, ein Jahr zu Wasser. Vor Str. Boelan (Riouw), Sambo Oh Sempeh. X. 1909. — VORSTER.

Diese in etwa einem Dutzend von Individuen gesammelten Würmer sind total mindestens bis ca. 90 mm lang. Es sind geschlechtsreife Tiere dabei, z.B. ein Weibchen mit grossen Eiern. Diese Eunicen zeigen gegenüber *Eun. australis* QUATR. ausser der bis ans Hinterende reichenden Kiemenzone schön die kurze Gliederung der Fühler. Die Kiemen beginnen bei 7 Exemplaren 5mal am 5ten und 2mal am 6ten Parapod.

Eunice australis QUATR.

Fundort: Ambon. — Gesundheitsbehörde.

Das einzige Exemplar ist total ca. 35 mm lang. An den Fühlern wie auch an den Analcirren ist eine scharfe längliche Gliederung vorhanden. Die Kiemen beginnen 1fädig am 4 ten und hören 1fädig am 29ten Parapod auf.

Eunice coccinea GR. ?

Fundort: Am Dampfponton, ein Jahr zu Wasser. Vor Str. Boelan (Riouw), Sambo Oh Sempeh. X. 1909. — VORSTER.

Unter dem geringen Material, das ich dieser *Eunice* zuordne, befinden sich 2 Individuen mit Kopf, beide ohne dorsales weisses Halsband am Vorderkörper. Das eine Tier ist ein kleineres, hinten nicht ganz vollständiges Exemplar von ca. 45 mm Länge mit noch ca. 96 Borstensegmenten und von ca. 2 - 2,5 mm Maximalbreite ohne Parapodien. Von den ungegliederten Fühlern überragen die 3 mittleren etwa zur Hälfte die Palpen nach vorn zu. Die Kiemen beginnen kurz und 1fädig am 14ten Parapod, sind im Maximum 3 - oder 4fädig und sind am letzten erhaltenen Segment noch 2fädig vorhanden. - Das andere Exemplar, bräunlich wie das 1ste, ist ein Vorderende von ca. 26 mm Länge und ca. 4 mm Breite, mit 37 Borstensegmenten, und hat Kiemen mit im Maximum 5 oder 6 Fäden, die rechts ganz kurz einfädig am 17ten Parapod, links noch etwas später beginnen.

Ausserdem liegen mehrere lange Körperstrecken mit Schwanzende, doch ohne Kopf vor, von denen das kürzeste ca. 44 mm lang ist, während andere bis doppelt so lang sind. Am kürzesten Hinterende sind überhaupt keine Kiemen mehr, an den 2 längsten Hinterenden noch Kiemen an vorderen Segmenten vorhanden. Die Hinterenden können zu keiner anderen *Eunice* von diesem Fundort gehören. Die Borsten dieser Würmer passen zu *Eun. coccinea.* Möglicherweise gehören die Hinterenden und die 2 Tiere mit Kopf nicht der gleichen Art an oder das an 1ster Stelle erwähnte Tier mit Kopf etwa zu *Eun. afra* PET.

Marphysa soembaensis n. sp. (Textfig. 2).

Fundort: Oestlich von Sindikiri Bai, S.W. Soemba. 3. III. 09. — Herausgelöst aus mergelartige, zwischen Ebbe und Flut am Strande liegenden Massen. — VAN DE SANDE.

Die 2 von dieser Art vorhandenen Exemplare sind mit zahlreichen Eiern vollgestopfte Weibchen und beide mehrfach zerbrochen; u.a. sind 2 vordere Körperstrecken mit Kopf und eine hintere Körperstrecke mit Analsegment erhalten. Es sind grössere Würmer von graubräunlicher Färbung, am Vorderkörper irisierend, das Buccalsegment ist dorsal rotbraun, vorn weisslich berandet.

Das stärkere Vorderende ist ca. 62 mm lang und ca. 7,5 mm maximalbreit ohne Parapodien, das schwächere Vorderende ca. 80 mm lang und ca. 5,5 mm maximalbreit. Von 2 erhaltenen mittleren Körperstrecken ist die stärkere, die nach ihrer Breite gewiss dem stärkeren Wurm angehört, ca. 55 mm lang mit etwa 153 Segmenten, die schwächere ca. 50 mm lang mit rund 120 Segmenten. Das Hinterende, nach seiner Breite vermutlich dem schwächeren Wurm zugehörend, ist mit etwa 150 Segmenten ca. 60 mm lang. Von den 2 Analcirren ist auf der einen Seite ein längerer stärkerer ungefähr von der Länge der 4 letzten Segmente vorhanden, auf der anderen Seite ein viel kürzerer dünnerer Cirrus.

Der Kopf ist vorn median eingeschnitten, die Kopffühler sind nur bei dem schwächeren Wurm in voller Länge erhalten. Die 3 mittleren Fühler, so gut wie gleich lang, überragen den Kopf vorn etwa um ihre halbe Länge. Die Fühler des äusseren Paares, etwa 2/3 so lang wie die mittleren und weiter nach vorn entspringend, überragen vorn den Kopf etwa um 1/2 bis 2/3 ihrer Länge.

Die Kiemen sind nur schwach entwickelt und treten bis nahe an das Hinterende des Körpers auf und sind bei dem schwächeren Wurm im Maximum 2 zuweilen 3fädig; bei dem stärkeren Wurm waren 2fädige Kiemen als Maximum die Regel, es mochten aber auch gelegentlich mal 3 Fäden vorkommen. Hinten sind an einer ansehnlichen Strecke der Kiemenregion die Kiemen 1fädig. Bei dem schwächeren Wurm treten Kiemen zuerst am ca. 40ten Borsten-

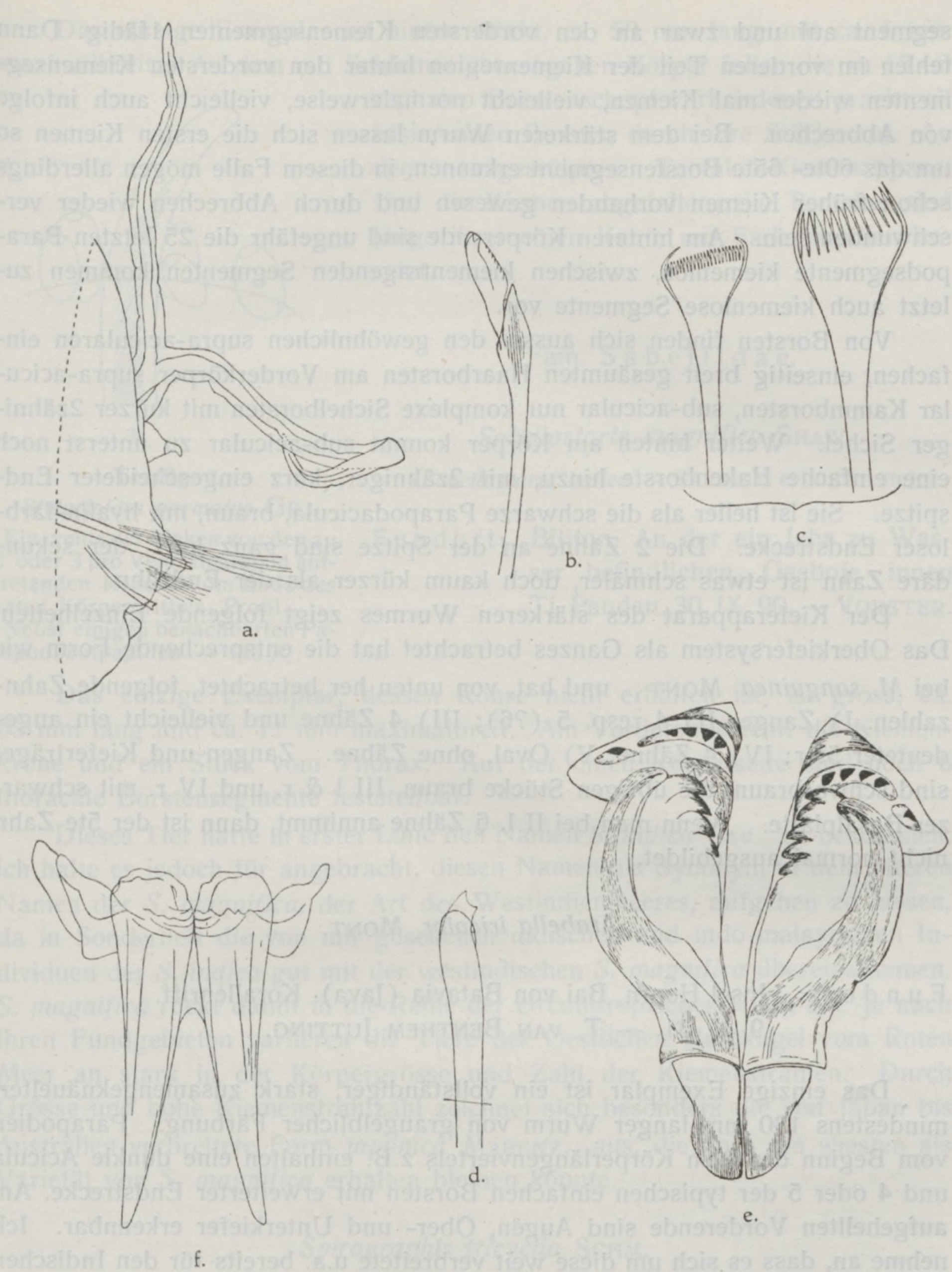


Fig. 2. *Marphysa soembaënsis* n. sp.

a. Parapod mit 2 fädiger Kieme von der vorderen Körperhälfte, aus der Strecke höchster Kiemenentwicklung. Von der Seite gesehen. — 29 ×
b. Komplexe Sichelborste aus derselben Körpergegend. Profil — 260 ×
c. 2 Kammborsten, von einem Parapod der hinteren Körperstrecke. Flächenansicht. — 400 ×
d. Ventraler Acicularhaken von der hinteren Körperstrecke. Die Scheiden am Ende abgebrochen. Profil — 327 ×
e. Oberkiefer. Von oben gesehen. — 21 ×
f. Unterkiefer. Von oben gesehen. — 21 ×

segment auf und zwar an den vordersten Kiemensegmenten 1fädig. Dann fehlen im vorderen Teil der Kiemenregion hinter den vordersten Kiemensegmenten wieder mal Kiemen, vielleicht normalerweise, vielleicht auch infolge von Abbrechen. Bei dem stärkeren Wurm lassen sich die ersten Kiemen so um das 60te- 65te Borstensegment erkennen, in diesem Falle mögen allerdings schon früher Kiemen vorhanden gewesen und durch Abbrechen wieder verschwunden sein. Am hinteren Körperende sind ungefähr die 25 letzten Parapodsegmente kiemenlos, zwischen kiementragenden Segmenten kommen zuletzt auch kiemenlose Segmente vor.

Von Borsten finden sich ausser den gewöhnlichen supra-acicularen einfachen, einseitig breit gesäumten Haarborsten am Vorderkörper supra-acicular Kammborsten, sub-acicular nur komplexe Sichelborsten mit kurzer 2zähniger Sichel. Weiter hinten am Körper kommt sub-acicular zu unterst noch eine einfache Hakenborste hinzu, mit 2zähniger, kurz eingescheideter Endspitze. Sie ist heller als die schwarze Parapodacicula, braun, mit hyalin-farbloser Endstrecke. Die 2 Zähne an der Spitze sind ganz kurz, der sekundäre Zahn ist etwas schmäler, doch kaum kürzer als der Endzahn.

Der Kieferapparat des stärkeren Wurmes zeigt folgende Einzelheiten. Das Oberkiefersystem als Ganzes betrachtet hat die entsprechende Form wie bei *M. sanguinea* MONT , und hat, von unten her betrachtet, folgende Zahnzahlen. I) Zange; II) 4 resp. 5 (?6); III) 4 Zähne und vielleicht ein angedeuteter 5ter; IV) 4 Zähne; V) Oval, ohne Zähne. Zangen und Kieferträger sind schwarbraun, die übrigen Stücke braun, III l & r. und IV r. mit schwarzer Basalplatte. Wenn man bei II l. 6 Zähne annimmt, dann ist der 5te Zahn nicht normal ausgebildet.

Arabella iricolor MONT.

Fundort: Insel Hoorn, Bai von Batavia (Java). Korallenriff.
9. V. 31. — T. VAN BENTHEM JUTTING.

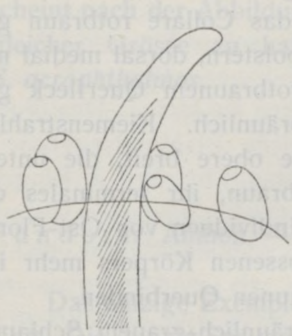
Das einzige Exemplar ist ein vollständiger, stark zusamengeknäuelter, mindestens 130 mm langer Wurm von graugelblicher Färbung. Parapodien vom Beginn des 2ten Körperlängenviertels z.B. enthalten eine dunkle Acicula und 4 oder 5 der typischen einfachen Borsten mit erweiterter Endstrecke. Am aufgehellten Vorderende sind Augen, Ober- und Unterkiefer erkennbar. Ich nehme an, dass es sich um diese weit verbreitete u.a. bereits für den Indischen und Pazifischen Ozean angegebene Art handelt.

Fam. Flabelligeridae.

Stylarioides parmatus GR.

Fundort: Madoera. — P. A. OUWENS

Das einzige Exemplar ist hinten intakt, ca. 50 mm lang und ca. 6 mm maximalbreit. An dem mit Schlamm überzogenen Körper fallen die zu 13 im cephalen Borstenschopf vorhandenen prachtvoll irisierenden Borsten durch ihre Stärke auf. An dem ausgestülpten Tentakel-Kiemenapparat sind die Kiemen abgefallen; die Tentakel sind längs ihrer einen Kante mit Fadenpapillen besetzt.



Textfig. 3.
Stylarioides parmatus GR.
Ein ventraler Haken von den zu 2 oder 3 pro Ventralparapod auftretenden Haken. Vom Ende des 1sten Körperdrittels Profil. Nebst einigen benachbarten Parapodhautpapillen. — 146 ×.

Fam. Sabellidae.

Sabellastarte magnifica SHAW.

(*Sabellastarte indica* — SAVIGNY et auctorum).

Fundort: Biliton. An der ein Jahr zu Wasser befindlichen Gasboje innen Tj. Pandan. 30. IX. 90. — VORSTER.

Das einzige Exemplar, dessen Röhre nicht erhalten ist, ist gross, ca. 63 mm lang und ca. 11 mm maximalbreit. Am Vorderende fehlt die Kiemenkrone und ein Stück vom Thorax. Auf der einen Körperseite sind noch 6 thoracale Borstensegmente feststellbar.

Dieses Tier hätte in erster Linie den Namen *S. indica* SAV. zu bekommen, ich halte es jedoch für angebracht, diesen Namen als Synonym in dem älteren Namen der *S. magnifica,* der Art des Westindienmeeres, aufgehen zu lassen, da in Sonderheit die von mir gesehenen indischen und indo-malayischen Individuen der *S. indica* gut mit der westindischen *S. magnifica* übereinstimmen. *S. magnifica* rückt damit in die Reihe der circumtropischen Arten ein. Je nach ihren Fundgebieten variieren die Tiere der Oestlichen Halbkugel vom Roten Meer an stark in der Körpergrösse und Zahl der Kiemenstrahlen. Durch Grösse und hohe Kiemenstrahlzahl zeichnet sich besonders die von Japan bis Australien verbreitete Form *japonica* MARENZ. aus, die noch am ehesten als Varietät von *S. magnifica* erhalten bleiben könnte.

Spirographis tricyclia SCHM.

Fundort: Banda. 1909. — P. A. OUWENS.
Ost-Flores. 8° 9′ 7″ S.Br. 123° 1′ 29″ O.L. — Von dem bei Springflut-Ebbe blossgelegten Riff von Poeloe Serbete und Poeloe Mas an der Nordküste von O. Flores.

Von den 4 Exemplaren mit noch weniger Röhren, von Banda ist das

längste ca 80 mm lang und ca. 6 - 6,5 mm maximalbreit. Eine der Kiemenkronen hat an der kleineren Kieme ca. 27, an der grösseren ca. 65 Strahlen. Die Körpergrundfarbe ist bräunlich-fleischfarben, das Collare rotbraun gefleckt, der Thorax ventral medial neben den Hakenpolstern, dorsal medial neben den Dorsalborstenbündeln mit segmentalem rotbraunem Querfleck gezeichnet. Kiemenblätter aussen grösstenteils rostbräunlich. Kiemenstrahlen hell, mit 2 rotbraunen Querbinden, von denen die obere breit, die untere schmal ist, oder Kiemenstrahlen grösstenteils rotbraun, ihr terminales ca. 1/3 - 1/2 hell. — Bei den wenigen, zerbrochenen Individuen von Ost-Flores zieht die Grundfarbe des in der Röhre eingeschlossenen Körpers mehr ins Ockergelbliche. Die Kiemen sind hell mit 2 rotbraunen Querbinden.

Die Röhren der Banda-Exemplare sind mit bräunlich-grauem Schlamm beklebt, zuweilen in helleren und dunkleren mit einander abwechselnden Querzonen, die Röhren der Flores-Exemplare mit grauweissem Schlamm und mit Korallensand.

Bei mehreren untersuchten Exemplaren fand ich stets 2 Ocellenpaare pro Kiemenstrahl. Von thoracalen Borstensegmenten sind bei 7 Exemplaren vorhanden 11; 12; 11 oder 12; 14; 15; 17 resp. 18; 13 oder 14 (Körper hier abgebrochen). An der Unterseite der Ventrallappen des Collares habe ich Papillen nicht feststellen können.

Diese *Spirographis* ist eine weiter verbreitete Warmwasserform des Indischen und Pazifischen Ozeans.

Branchiomma vesiculosum MONT.

Fundort: Ambon. — Gesundheitsbehörde.

Das einzige Exemplar ist vollständig und exklus. Kiemenkrone ca. 30 mm lang. Der Körper ist bräunlich, die Kiemenkrone blass bräunlich. z.T. mit Schlamm besetzte Röhre lag neben diesem Wurm und der *Dasychone cingulata* vom gleichen Fundort und muss zu einer dieser 2 Sabelliden gehören.

Der Thorax enthält 10 Borstensegmente, jede Kieme 18 oder 19 Strahlen, von denen der medialste Strahl dicker als die übrigen Strahlen ist und ein erheblich grösseres Strahlauge hat als jene. Die Strahlaugen sind kugelig. Das Collare ist vielleicht am richtigsten als 2teilig zu charakterisieren; würde man die 2 dorsal an der Basis der Kiemenkrone vorhandenen häutigen Lappen noch mitrechnen zum Collare, so wäre dieses 4teilig zu nennen etwa wie bei *Distylia (Bispira)*.

Diese Art ist bereits für den Indischen Ozean angegeben. Ich kann an diesem Wurm keinen greifbaren Unterschied von europäischen Exemplaren finden.

GRUBE'S *Sabella acrophthalmos* (1878) von den Philippinen lässt sich nicht mit dem vorliegenden Wurm in Verbindung bringen, da u.a. die Kiemenstrahl-

augen an allen Strahlen gleich gross sein sollen. — Die von BEDDARD (1889) als *Branchiomma intermedium* vom Mergui-Archipel beschriebene Sabellide scheint nach der Abbildung ebenfalls Kiemenstrahlaugen von an allen Strahlen gleicher Grösse zu haben und ist möglicherweise die gleiche Art wie *S. acrophthalmos.*

Dasychone cingulata GR.

Fundort: Ambon. — Gesundheitsbehörde.

Das einzige Exemplar ist vollständig und exklus. Kiemenkrone ca. 25 mm lang. Die dunkle Spritzerzeichnung des Körpers ist sehr spärlich. Die Bauchfläche ist in der Mitte mehr oder weniger dunkelbraun, am Abdomen durch einen grundfarbigen Medianlängsstreif halbiert.

II. HIRUDINEA.

Fam. Hirudinidae.

Limnatis (Hirudinaria) javanica WAHLB.

Fundort: Java. Ranoe Pening bei Ambarawa. 13. VIII. 30. — T. VAN BENTHEM JUTTING; See von Bagendiet (Garoet). 26 II. 27; See von Pendjaloe. VII. 1927; Buitenzorg. Tji Karet. 14. II. 27; und Tjiomas. 10. II. 27; und 10. VI. 27. — Alle A. G. VORSTMAN.

Diese in Java verbreitete grosse Hirudinee hat mir in einer Anzahl von Exemplaren, kleinen bis grossen, vorgelegen. Das wohl grösste ist ca. 85 mm. lang und ca. 13 mm. maximalbreit. Nüchterne und dabei gut gestreckte Exemplare sind in den hinteren ca. 2/3 der Körperlänge oder auch ganz nahezu parallelseitig; ein solches Exemplar ist z.B. ca. 75 mm. lang bei einer Breite von ca. 7.5 mm.

Hirudo spec.

Fundort: Nördl. Neu-Guinea. Sawia. VIII. 1911. — K. GJELLERUP.

Das einzige Exemplar ist ein grosses Tier von *Hirudo* oder *Limnatis*-Habitus, mit Blut im Darm, stark abgeplattet, ca. 73 mm. lang und ca. 13 mm. maximalbreit. Die Färbung ist jetzt blass ockergelblich, ohne irgendeine noch erkennbare Zeichnung, ventral blasser, mehr graugelblich. Da der Körper hart

und mit seinem 1sten Längenviertel so unglücklich ventralwärts umgebogen ist, konnte er nur unter Bruch der Umbiegungsstelle auseinander gestreckt werden.

Die Analhaftscheibe ist so breit wie der Körper in seiner hinteren Hälfte. Es scheinen kleine Hautpapillen vorhanden zu sein, Genaueres lässt sich nicht erkennen. Die Ringelzahl beträgt ca. 103. Der After ist klein. Das Vorderende des Egels ist spitzer als bei *Limnatis,* im Bereiche der Mundsaugscheibe nicht wieder verbreitert. Der Genitalporen-Abstand beträgt 5 Ringel, der ♂-Porus liegt zwischen dem 24ten und 25ten postoralen ventralen Ringel. An der Unterseite der Oberlippe ist von einer Medianlängsfurche nichts Sicheres zu erkennen. Die Kiefer sind höchstens als mässig gross zu bezeichnen, und lassen von Oberflächenpapillen im Sinne von *Limnatis* und von Zähnen nichts erkennen, die Zähne sind vermutlich abgefallen oder zerstört.

Die feststellbaren Charaktere würden zu der in Neu-Guinea vertretenen Gattung *Hirudo* passen, das Tier mag dem dort vorkommenden *H. elegans* GR. angehören.

Fam. Haemadipsidae.

Haemadipsa zeylanica MOQU.-TAND.

Fundort: Mittleres Ost-Borneo. Long Petah. IX. 1925. — F. H. ENDERT.

Von den wenigen Exemplaren sind 2 vollgesogen. Die nüchternen Individuen sind matt hell rostgelblich, ventral etwas reiner und heller als dorsal. 2 grosse Individuen haben keine anderweitige Zeichnung, sind am Vorder- und Hinterende mehr graulich, die kleinen Individuen haben einen dorsomedianen schwarzen Längsstreif. Die 3te augentragende Areolenquerreihe hat eine mediane unpaare Areola.

Haemadipsa silvestris R. BLANCH.

Fundort: Java. Tjisaroea. Gedeh. 1000 m. VIII. 1930. — K.W. DAMMERMAN.

Die in kleinerer Anzahl vorliegenden Egel sind nüchtern und in Alkohol konserviert, die 2 grössten sind ca. 16 und 18 mm. lang.

Die Grundfärbung ist blass rostgelblich; Mundsaug-, und Afterhaftscheibe sind graublau, ein ebenso gefärbter dorso-medianer Längsstreif ist stärker oder schwächer ausgeprägt. Rücken jederseits dieses Längsstreifens breit und ausgedehnt schwarz gefärbt in Gestalt von 4 mehr oder minder zusammengeflossenen oder noch wieder hell unterbrochenen Längsstreifen. Der Rücken ist zwischen den paramedianen schwarzen Längsstreifen graublau, nach hinten zu mehr grundfarbig. Lateral ist eine Längsreihe schwarzer Flecken vorhanden. Die Haftpapille vorn an der Afterhaftscheibe ist rudi-

mentär. Zwischen der 2ten und 3ten augentragenden Areolenquerreihe ist eine intercalierte Areolenquerreihe vorhanden, ebenso kommen mediane intercalierte Areolen, zum mindesten eine solche, auf der Mundsaugscheibe vor.

Diese Egel passen in der Färbung und Zeichnung zu den 2 *Haemadipsa*-Exemplaren der Deutschen Limnologischen Sunda-Expedition von Ostsumatra aus dem Urwaldgebiet von Ranau. I. 1929. und stimmen auch sonst als Art mit letzteren überein. Ich betrachte sie einstweilen als Färbungsvarietät von *H. silvestris*. Da mir kein grösseres Material solcher Haemadipsen mit der Färbung der Mundsaug-, und Afterhaftscheibe, wie sie *H. ornata* J. P. MOORE mit ihnen gemeinsam hat, und auch kein Material von *H. ornata* aus anderen Gebieten, speziell aus deren Originalfundgebiet, zur Verfügung steht, so sehe ich von weiteren Betrachtungen über die Artberechtigung der *H. ornata* ab.

Haemadipsa spec.

Fundort: Südliches Mittel-Timor. Soë. 2500 Fuss. I. 1929 — M. E. WALSH.

Das einzige Exemplar ist ca. 13 mm. lang, von schlank spindelförmiger, vorn zugespitzter Körperform, und hat daher vermutungsweise etwas Nahrungsblut im Darm. Die Erhaltung des jetzt bräunlich gefärbten Körpers ist zu schlecht, als dass man Genaueres über das Tier aussagen könnte. Die Körperwand hängt dünn und durchscheinend wie ein Sack lose um den weichen Darmtractus herum. Von Ringelung ist daher nichts Rechtes erkennbar mit Ausnahme des vordersten Körperendes. Die Afterhaftscheibe ist unter den obwaltenden Umständen kaum 1/3 so breit wie der Körper hinten breit. Es sind 3 Kiefer wie bei *Haemadipsa* vorhanden. Ich nehme an, dass es sich um eine Art der Gattung Haemadipsa handelt. Das Fundgebiet dieses Egels — der Fundortsangabe ist das wort „Blutegel" hinzugefügt —, ist von Interesse für die Verbreitung der Gattung *Haemadipsa*.

Chtonobdella tristriata GODD.

Fundort: Neu-Guinea. Rouffaer-Fluss. VII. 1926. — W. DOCTERS VAN LEEUWEN.
Neu-Guinea. Mamberamo Fluss. Albatros Biwak. ± 50 m. VII. 1926. — W. DOCTERS VAN LEEUWEN.

Von den 2 Exemplaren dieses auf Neu-Guinea weit verbreiteten Landblutegels war das Tier vom Mamberamo eingetrocknet, gehört aber wohl sicher dieser Art an.

Das andere Exemplar, ca. 17 mm. lang, hat eine rostgelbliche Grundfärbung. Während die Dorso-Mediane breit grundfarbig ist, ist der Rücken im übrigen mit reichlicher schwärzlicher Längsstreifung versehen. An der Bauchseite ist die Ventro-Mediane ziemlich breit matt schwärzlich gefärbt.

Die Genitalporen sind nicht erkennbar. Die Afterhaftscheibe läuft vorn breit dreieckig aus, was im Sinne einer haemadipsoiden Greifpapille zu deuten sein mag.

Nach meiner Ansicht sind am Vorderkörper eine Anzahl verlängerte Ringel vorhanden, wie ich sie bei Neu-Guinea-Tieren dieser Art aus dem Naturhistorischen Museum in Brüssel (1931) beobachtete, doch ist der Körperzustand des Tieres nicht besonders günstig für die Erkennung derselben.

Fam. Nephelidae.

Barbronia weberi R. BLANCH.

(*Herpobdella formosana* — OKA 1929 und 1930).

Fundort: Java. Buitenzorg. Botanischer Garten. 6. 9. 27. — A. G. VORSTMAN.

Das einzige Exemplar ist ca. 18 mm. lang, matt graulich, ventral unbedeutend heller als dorsal. Nach seinem sonstigen Aussehen ist es nicht geschlechtsreif. Ich habe diese wie die folgende Art für Java schon (1931) aus der Sammlung der Deutschen Limnologischen Sunda-Expedition angegeben.

OKA hat nach jungen Individuen aus Formosa (Révision des Herpobdelles d'extrême Orient. — Proc. Imper. Acad. Tokyo. V. 1929) eine Nephelide unter dem Namen *Herpobdella* beschrieben, deren Beschreibung er nach grösseren Exemplaren später (Sur l'anatomie de l' *Herpobdella formosana,* — loc. cit. VI. 1930. p. 279-281) in wichtigen Punkten ergänzt hat. Ich kann hiernach bei *Herpobdella formosana* keinen Unterschied finden von *Barbronia weberi* und sehe mich daher veranlasst, erstere als Synonym mit *Barbronia weberi* zu vereinigen.

Das Vorkommen von *B. weberi* auf Formosa ist bezüglich der geographischen Verbreitung dieser Art auch insofern von Interesse, als diese gleichfalls in China vorkommt, von wo sich im Hamburger Zoologischen Museum 2 Exemplare von ca. 32 und 40 mm. Länge von Fokien und 4 auffallend grosse Exemplare bis zu der Maximallänge zweier Tiere von ca. 70 und 74 mm. von Futschau befinden. Auf jeder Schlundfalte stehen hier 2 stilettförmige Zähne hinter einander, die Genitalporen und die 2 accessorischen Ventralporen haben die *B. weberi* entsprechende Lage.

Herpobdelloidea lateroculata KAB.

Fundort: Java. Kamodjan bei Garoet. Danoe Pateungteun. VII. 1927. — A. G. VORSTMAN.

Das grössere von den 2 vorhandenen Exemplaren ist ca. 7.5 mm. lang.

Scaptobdella horsti R. BLANCH.

Fundort: Java. Diëng Plateau. Tegal Pangonan. ± 2200 m. 6. VIII. 1930. T. VAN BENTHEM JUTTING.

Das einzige Exemplar ist gestreckt, ca. 84 mm. lang und ca. 5,5 - 6 mm. maximalbreit, im Querschnitt mehr rundlich, nur im hinteren Teil etwas abgeplattet. Die Färbung ist dorsal grauschwärzlich, ventral unbedeutend heller, mit einer Spur von bräunlich. Mundsaug- und Afterhaftscheibe oben und unten auf einem Randstreifen weissgelblich. Dorsal auf den hinteren 2/3 des Körpers, am deutlichsten auf dem letzten Drittel, finden sich Querreihen graugelblicher, sich vom Untergrunde heller abhebender Warzen, davon ca. 6 Querreihen hinter dem After auf dem dunklen Teile der Afterhaftscheibe. An der Bauchfläche sind nur die Nephridialpapillen graugelblich.

Dank der deutlichen Erkennbarkeit der Nephridialpapillen sind die Segmentgrenzen gut unterscheidbar. Die Normalsegmente sind primär 6 ringelig, sekundär 9 ringelig, indem die Ringel 1, 2 und 6 lang und sekundär quergefurcht-halbiert sind. Der 5te Segmentringel ist wohl der kürzeste von allen Segmentringeln. Bei der Annahme, dass nur der 5te Segmentringel die Bezeichnung „kurz" wirklich verdiene, während die übrigen 5 Ringel als mehr oder weniger lang zu gelten hätten, so könnte man das Segment auch als sekundär 11 ringelig charakterisieren.

Der Genitalporen-Abstand beträgt ca. 5½ Ringel, wenn das Normalsegment als primär 6 ringelig zu Grunde gelegt wird. Der ♂-Porus liegt um 3 Ringel entfernt hinter der Vordergrenze seines Segments, der ♀-Porus wohl etwas hinter der halben Länge seines Ringels.

Fam. Clepsinidae.

Clepsine weberi R. BLANCH.

Fundort: Java. Kleiner See von Tjigombong. 1. IX. 30. — T. VAN BENTHEM JUTTING. See von Tjigombong. IV. 1927; Buitenzorg. Botanischer Garten. VI. 1927; Rawah Bening. Süd Kediri. 19. IX. 27; Kamodjan. Danoe Pateungteun. VII. 1927; See von Pendjaloe. VII. 1927; See von Ngebel, bei Madioen. ± 2500 Fuss. — Alle A. G. VORSTMAN.

Die Individuen dieser Art erreichen eine Maximallänge von ca. 9 und 10,5 mm. Als Färbungen sind zu nennen blass bräunlich und weisslichgrau. Neben den Tieren aus Kleinen See von Tjigombong lag ein rundlicher, von

einer zarten hyalinen Hülle umgebener Klumpen dunkelgelber Eier, der zu einem dieser Tiere gehören wird. Das Exemplar von dem Fundort Botanischer Garten. VI. 1927. hatte Junge am Bauche. Lose Junge lagen neben den Tieren von Rawa Bening. Das eingetrocknete, doch vermutlich dieser Art angehörende Exemplar vom See von Ngebel ist bemerkenswert wegen seines Höhenfundortes in mehr als 700 m. Höhe. In der Sammlung der Deutschen Limnologischen Sunda-Expedition fand sich diese Art noch höher, 1000 m. hoch, in Java.

Haementeria fulva HARD.

Fundort: Java. Buitenzorg. Botanischer Garten. 16. III. 27, VI. VII und 6. IX. 1927. — See von Pendjaloe. VII. 1927. — Alle A. G. VORSTMAN.

Die etwa 20 Exemplare dieses Egels sind klein bis gross und erreichen eine Maximallänge von ca. 9, in einem Falle von ca. 11 mm. Als Färbungen sind zu verzeichnen bräunlich und graugelblich. Die Körperform ist je nach den Umständen verschieden, ziemlich gestreckt und dabei schmal oder ober kontrahiert und breit. Unter geeigneten Bedingungen sind dorsale Papillen erkennbar, z.B. der dorso-mediane Papillenlängskiel. Unter den Tieren von Botanischer Garten. 6. IX. 27. enthalten einige Nahrungsblut und tragen 2 Tiere Junge am Bauche. Ein Exemplar vom See von Pendjaloe trägt zahlreiche Junge am Bauche, die Jungen haben Nahrungsblut im Darm. 2 Tiere von demselben Fundort enthalten Nahrungsblut. Neben den Tieren von Botanischer Garten VI. 1927. liegt eine Anzahl abgefallener Jungen im Glase. Angaben über etwaige Wirtstiere sind bei diesem Material nicht vorhanden. Von der Deutschen Limnologischen Sunda-Expedition wurde diese Art an der Schildkröte *Trionyx cartilagineus* auf Java erbeutet.

THE CRINOIDS OF THE BUITENZORG MUSEUM.

By

AUSTIN H. CLARK

(U. S. National Museum).

The director of the Buitenzorg Museum has recently been so very kind as to submit to me for study the collection of comatulids belonging to that institution and to the Laboratory for Marine investigations at Batavia.

Nearly all the specimens included in the collection are from the waters about Sumatra, Java and southern Borneo, a particularly interesting region on which we have as yet relatively little information.

The collection includes representatives of 24 species. Although none of these species are new, several of the locality records and a number of the individual specimens are of very considerable interest.

Crossometra helius was previously known only from the five specimens collected by the „Siboga" in the Kei Islands. *Dichrometra tenuicirra* was heretofore only known from the twenty-six individuals dredged by the „Siboga" between Borneo and eastern Java. *Capillaster macrobrachius* was previously only known from the type specimen from the China Sea and another dredged by the „Siboga" on the Borneo Bank.

The large specimen of *Capillaster multiradiata* from St. Nicolaas Bay with only ten arms is worthy of note. The collection includes no less than fifty-five specimens of *Craspedometra acuticirra* of which previously only eleven have been recorded, nine of which I have personally examined.

The additional records for *Asterometra mirifica* and *Pterometra pulcherrima* are of much interest.

The specimen of *Comatula pectinata* from off Flat Hook, Borneo, with 18 arms has the largest number of arms of any individual of this species yet found, and is the only one possessing a IIIBr series. One example with 17 arms has been recorded from Singapore, and another with 17 arms is known from the Java Sea north of western Java. All three of these specimens are undergoing adolescent autotomy.

Two of the eleven specimens of *Amphimetra molleri* in the collection have 11 arms, a single IIBr 2 series being present in each case. Heretofore the genus *Amphimetra* was supposed to include exclusively 10-armed forms. It is a somewhat anomalous type, and the occurrence in individuals with more than 10 arms of IIBr 2 series instead of IIBr 4 (3 + 4) series as would be expected in a genus of the family *Himerometridæ* emphasizes its peculiarities.

The genus *Pontiometra* is herein placed in the family *Colobometridæ* on the basis of the paired dorsal spines on the earlier cirrus segments. The family *Colobometridæ* includes a rather heterogeneous assemblage of genera which share in common only the lateral broadening of the dorsal processes of the earlier, or all, the cirrus segments, which form transverse ridges or paired or tripled spines. Since this feature is especially characteristic of the genus *Pontiometra* there is no reason for not including it in this family.

Of the 24 species represented in the present collection all but three — *Craspedometra acuticirra, Heterometra pulchra* and *Amphimetra molleri* — were included in the extensive collections made by the „Siboga", and their synonymy will be found in the author's report on the unstalked crinoids of the „Siboga" Expedition (Livr. LXXXIII, March 1918), in which the synonymy of *Amphimetra molleri* also is included. *Heterometra pulchra* was described in the author's memoir on the crinoids of the Indian Ocean (Echinoderma of the Indian Museum, Part VII, Crinoidea, Calcutta, November 22, 1912), p. 317, and the synonymy of *Craspedometra acuticirra* will be found on p. 117 of the same memoir.

Detailed accounts of all the known species of *Comasteridæ,* to which family half of the species included in the present collection belong, are given in the author's recent monograph of that group (Bulletin 82, United States National Museum, vol. 1, Part 3, pp. i-vii, 1 - 816; 82 plates; Washington, D. C., March 21, 1931). In this memoir are included keys to all the subfamilies and higher groups of comatulids, as well as to all the genera and species of *Comasteridæ*.

Superfamily **Comasterida.**

Family COMASTERIDA.

Subfamily Capillasterinae.

Comatella nigra (P. H. CARPENTER).

Locality. — Near Cape Dato, Madura (off the eastern end of Java) (lat. 7° 33′ S., long. 113° 37′ E.); November 7, 1908 (Gier 13, Exp. 3). One specimen.

Comatella stelligera (P. H. CARPENTER).

Locality. — Dobo, northern side of the islet of Wamma, Aru Islands (lat. 5° 45′ S., long. 134° 20′ E.); February, 1908. One specimen.
Notes. — The specimen has 47 arms; the cirri have 18 - 21 segments.

Capillaster macrobrachius (HARTLAUB).

Locality. — Java Sea, northnortheast of Indramayu Point, Java (lat.

4° 55′ S., long. 108° 56′ E.); October 23, 1907 (Gier 3, Exp. 20). One specimen.

Notes. — There are 28 + arms. Of the seven IIBr series present five are 4 (3 + 4) and two are 2. Of the ten IIIBr series present eight are 3 (2 + 3), one is 4 (1 + 2, 3 + 4), and one is 2. There is a single IVBr 3 (2 + 3) series.

Capillaster multiradiata (LINNÉ).

Localities. — Great Kei, Kei Islands; March 4, 1928 (van Ledelholl, No. 53). One specimen.

Northwest of Rembang, Java (lat. 5° 39′ S., long. 111° 19′ E.); October 19, 1908 (Gier 12, Exp. 14). One specimen.

North of central Java (lat. 5° 41′ S., long. 109° 21′ E.); November 21, 1907 (Gier 4, Exp. 10). Two specimens.

Nassi Besar, northern end of Sumatra; 9 meters; otter trawl; June 3, 1908 (Gier 9). One specimen.

St. Nicolaas Bay, western end of Bali; September 7, 1909 (Gier 24, Exp. 6). One specimen.

Sabang Bay, northern end of Sumatra; May 1908 (Gier 9). Two specimens.

Notes. — The specimen from Great Kei has 11 arms which are about 110 mm. long.

The example from northwest of Rembang has 21 arms. The cirri have 27 - 29 segments and are 23 mm. long.

Of the two specimens from north of central Java one is rather large with 30 arms and the other is a small 10-armed example.

The specimen from Nassi Besar is typical.

The example from St. Nicolaas Bay has only 10 arms.

Of the two specimens from Sabang Bay one has 20 arms, with ten IIBr 4 (3 + 4) series, and the other has 17 arms, with seven IIBr 4 (3 + 4) series.

Subfamily Comactiniinae.

Comatula micraster A. H. CLARK.

Locality. — Off Cape Jabung, northern coast of southern Sumatra (lat. 1° 03′ S., long. 104° 35′ E.); July 3, 1908 (Gier 9, Exp. 19). One specimen.

Notes. — Three cirri 8 mm. long with 12 segments are attached to two of the sides of the pentagonal centrodorsal, of which the other three sides are depressed to the level of the radial pentagon.

Comatula pectinata (LINNÉ).

Localities. — Off Flat Hook, southern Borneo (lat. 3° 46′ S., long. 111° 50′ E.); 15 - 18 meters (Gier 12, Exp. 6). One specimen.

East road of Indramayu (115 miles east of Batavia), Java (Gier 16, Exp. 3). Four specimens.

Off Cape Selatan, southern Borneo (lat. 4° 25′ S., long. 114° 31′ E.); October 4, 1908 (Gier 12, Exp. 3). Two specimens.

North of western Java (lat. 5° 22′ S., long. 107° 42′ E.); 23 meters; November 15, 1907 (Gier 4, Exp. 2). Four specimens.

North of western Java (lat. 5° 16′ S., long. 106° 24′ E.); June 6, 1909 (Gier). Two specimens.

Off Cape Jabung, northern coast of southern Sumatra (lat. 1° 03′ S., long. 104° 35′ E.); July 3, 1908 (Gier 9, Exp. 19). Three specimens.

Notes. — The specimen from off Flat Hook, Borneo, has 18 arms. There are seven IIBr series and one external IIIBr series present. All the division series are 2 (1 + 2). One post-radial series is undergoing adolescent autotomy, bearing on the first brachial two IIBr series, one of which carries a IIIBr series externally.

The four specimens from Indramayu are rather large and slender.

The two examples from off Cape Selatan, Borneo, are rather large, and are of the stout armed type.

The four specimens from lat. 5° 22′ S., long. 107° 42′ E. are large and slender armed with 10, 11, 12 and 13 arms. In those with 11 and 13 arms the cirri are entirely confined to the interradial angles of the centrodorsal, there being five pairs of cirri in the 13-armed specimen and one pair and four single cirri in the 11-armed specimen. These two specimens should undoubtedly be referred to *Comatula pectinata* var. *purpurea*.

The two examples from lat. 5° 16′ S., long. 106° 24′ E. are rather large and are of the stout armed type.

The three specimens from off Cape Jabung, Sumatra, are rather large. One has 11 and the other two have 10 arms.

Subfamily Comasterinae.

Comaster multibrachiata (P. H. CARPENTER).

Locality. — South of the eastern end of Java (lat. 8° 47′ S., long. 114° 38′ E.); 30 - 36 meters; November 10, 1908 (Gier 13, Exp. 7). One specimen.

Comaster distincta (P. H. CARPENTER).

Locality. — St. Nicolaas Bay, on the western end of Bali; September 7, 1909 (Gier 24, Exp. 6). One specimen.

Comanthina schlegelii (P. H. CARPENTER).

Localities. — South of the eastern end of Java (lat. 8° 47′ S., long.

114° 38′ E.); 30 - 36 meters; November 11, 1908 (Gier 13, Exp. 7). One specimen.

Nassi Besar; 15 meters; June 16, 1908 (Gier 9).

Notes. — The specimen from south of the eastern end of Java is large and typical.

Comantheria briareus (BELL).

Locality. — Sabang Bay, northern end of Sumatra; May 1900 (Gier 9). One specimen.

Comanthus (Cenolia) bennetti (J. MÜLLER).

Locality. — Near Ajer Melit; P. Weh, May 9, 1908 (Gier 9).

Notes. — This is a fine example of the species.

Comanthus (Comanthus) parvicirra (J. MÜLLER).

Locality. — Sebesi Island; H. BOSCHMA, April 1921. One specimen.

Superfamily **Mariametrida.**

Family ZYGOMETRIDAE.

Zygometra comata A. H. CLARK.

Locality. — Java Sea, northnortheast of Indramayu Point, Java (lat. 4° 56′ S., long. 108° 56′ E.); October 23, 1907 (Gier 3, Exp. 20). One specimen.

Notes. — This example has 18 arms.

Family HIMEROMETRIDAE.

Himerometra magnipinna A. H. CLARK.

Locality. — Nassi Besar; 9 meters; otter trawl; June 4, 1908 (Gier 9). One specimen.

Craspedometra acuticirra (P. H. CARPENTER).

Localities. — Off Cape Jabung, northern coast of southern Sumatra (lat. 1° 03′ S., long. 104° 35′ E.); July 3, 1908 (Gier 9, Exp. 19). Three specimens.

Near Deli, northern Sumatra (lat. 3° 40′ N., long. 99° 10′ E.); 16-18 meters; June 25, 1908 (Gier 9, Exp. 14). Forty-eight specimens.

Malacca Strait, near the mouth of the Deli River, N.E. Sumatra (lat. 3° 53′ N., long. 98° 46′ E.) 10 meters; June 22, 1908 (Gier 9, Exp. 12). Four specimens.

Notes. — One of the specimens from off Cape Jabung has 28 arms and another has 22 arms.

Nine of the specimens from lat. 3° 40′ N., long. 99° 10′ E. have 22 (one), 23 (two), 24 (three), 26 (one), 28 (one) and 29 (one) arms. In the specimen with 28 arms the arms are about 140 mm. long.

In one of the specimens from lat. 3° 53′ N., long. 98° 46′ E. there are 35 arms; all of the IIIBr series are 2.

Heterometra crenulata (P. H. CARPENTER).

Localities. — Off southeastern Borneo (lat. 3° 12′ S., long. 116° 38′ E.); 14-19 meters (Gier 14, Exp. 4). One specimen.

North of central Java (lat. 5° 41′ S., long. 109° 21′ E.); November 21, 1907 (Gier 4, Exp. 10). Four specimens.

North of western Java (lat. 5° 22′ S., long. 107° 42′ E.); 23 meters; November 15, 1907 (Gier 4, Exp. 2). Two specimens.

Off Cape Jabung, northern coast of southern Sumatra (lat. 1° 03′ S., long. 104° 35′ E.); July 3, 1908 (Gier 9, Exp. 19) Two specimens.

Notes. — The four specimens from north of central Java are all small.

One of the specimens from north of western Java has 10 and the other has 11 arms. The lateral processes on the segments of the proximal pinnules are strongly developed, but slender.

One of the specimens from off Cape Jabung, Sumatra, has 22 arms. Of the ten IIBr series nine are 4 (3 + 4) and one is 2. There is one IIIBr 4 (3 + 4) series following a IIBr 2 series, and one IIIBr 2 series following a IIBr 4 (3 + 4) series. Both of the IIIBr series are internally developed.

Heterometra quinduplicava (P. H. CARPENTER).

Locality. — North of central Java (lat. 5° 41′ S., long. 109° 21′ E); November 21, 1907 (Gier 4, Exp. 10). One specimen.

Notes. — The specimen is small with 16 arms, and is undergoing adolescent autotomy.

Heterometra pulchra A. H. CLARK.

Locality. — Near Deli, northern Sumatra (lat. 3° 40′ N., long. 99° 10′ E.); 16-18 meters; June 25, 1908 (Gier 9, Exp. 14). Two specimens.

Amphimetra molleri (A. H. CLARK).

Localities. — North of central Java (lat. 5° 41′ S., long. 109° 21′ E.); November 21, 1907 (Gier 4, Exp. 10). One specimen.

Off Cape Jabung, northern coast of southern Sumatra (lat. 1° 03′ S., long. 104° 35′ E.); July 3, 1908 (Gier 9, Exp. 19). Four specimens.

Near Deli, northern Sumatra (lat. 3° 40′ N., long. 99° 10′ E.); 16 - 18 meters; June 25, 1908 (Gier 9, Exp. 14). Five specimens.

Near Olehleh, at the northwestern end of Sumatra (Gier 9, Exp. 4). One specimen.

Notes. — One of the specimens from off Cape Jabung has 11 arms, one IIBr 2 series being present.

One of the specimens from near Deli has one IIBr 2 series and 11 arms.

Family MARIAMETRIDAE.

Dichrometra tenuicirra A. H. CLARK.

Localities. — North of central Java (lat. 5° 41′ S., long. 109° 21′ E.); November 21, 1907 (Gier 4, Exp. 10). Five specimens.

Java Sea, northnortheast of Indramayu Point, Java (lat. 4° 55′ S., long. 108° 56′ E.); October 23, 1907 (Gier 3, Exp. 20). Two specimens.

Notes. — The largest specimen from north of central Java has 26 arms.

Family COLOBOMETRIDAE.

Pontiometra andersoni (P. H. CARPENTER).

Localities. — Northwest of Rembang, Java (lat. 5° 39′ S., long. 111° 19′ E.); October 19, 1908 (Gier 12, Exp. 14). Three specimens.

Java Sea, northnortheast of Indramayu Point, Java (lat. 4° 55′ S. long. 108° 56′ E.); October 23, 1907 (Gier 3, Exp. 20). One specimen.

Superfamily **Tropiometrida.**

Family THALASSOMETRIDAE.

Subfamily Ptilometrinae.

Asterometra mirifica A. H. CLARK.

Locality. — St. Nicolaas Bay, western end of Bali; September 7, 1909 (Gier 24, Exp. 6). Four specimens.

Notes. — One of the specimens has 11 arms 100 mm. long, one IIBr 2

series being present; the longest cirri have 93 segments. Another specimen has 10 arms 100 mm. long; the longest cirri have 95 segments. The two other specimens are small; each has 10 arms.

Pterometra pulcherrima (A. H. CLARK).

Locality. — South of the eastern end of Java (lat. 8° 47′ S., long. 114° 38′ E.); 30 - 36 meters; November 10, 1908 (Gier 13, Exp. 7). One specimen.

Notes. — This is a fine typical example of the species. There are 18 arms 80 - 90 mm. long. The cirri are composed of 88 - 92 segments and are 60 - 75 mm. long. On one of the cirri the terminal claw has at the base on the dorsal side a process exactly resembling an opposing spine that rises to a height equal to about half the width of the base of the terminal claw.

Family CHARITOMETRIDAE.

Crossometra helius (A. H. CLARK).

Locality. — Bali Sea (lat. 7° 35′ S., long. 114° 42′ E.); about 200 meters; Dr. Th. MORTENSEN'S South Africa — Java Expedition, 1929-'30; April 10, 1929. One specimen.

Notes. — This specimen has 26 arms about 150 mm. long. The cirri are 30 - 38 mm. long and are composed of 20 - 22 segments.

SOME NEW OR RARE FISHES OF THE INDO AUSTRALIAN ARCHIPELAGO II [1])

By

Dr. J. D. F. HARDENBERG.

(Laboratorium voor het Onderzoek der Zee, Batavia).

Family CLUPEIDAE.

SPRATELLOIDES BLEEKER.

Spratelloides gracilis (SCHL.)

B. 6, D. 12 — 13, A. 13, P. 11 — 12, V. 8, L. 1. about 45, L.tr. 8 — 9.

Height about 8, head 4.2 — 4.4 in length without caudal. Eye 4 in head. Snout pointed, longer than eye. Maxillary reaching to frontmargin of eye. Origin of dorsal in the midst between snout and caudal or somewhat nearer to snout. Anal as long as 1½ eye, nearer to caudal than to ventrals. Ventrals below second half of dorsal. Pectorals somewhat shorter than eye and snout. Caudal 7 in length of body and head. About 30 gillrakers. A silvery lateral band. Fins hyaline.

Six specimens, with a length of 5½ — 6½ cm. from the island of Temiang, Lingga Archipelago (Sumatra). Date November 1928.

My specimens quite agree with the original description. The species is rather common in the clear and deep waters of the Moluccas and on the coast of Celebes, but as far as yet has not been recorded west of the Kangean Archipelago. The occurrence so far to the West on the Sunda-shelf (near Singapore) is therefore quite unexpected.

Literature:

1. *Clupea gracilis* SCHLEGEL. Fauna Japonica. Poissons 1847 pag. 238.
2. *Clupea argyrotaenia* BLEEKER. Journal Ind. Arch. III 1849 pag. 72.
3. *Spratelloides argyrotaenia* BLEEKER. Verh. Bat. Gen. XXIV 1852 pag. 29.
4. *Spratelloides gracilis* GUENTHER. Cat. Brit. Mus. VI 1868 pag. 465.
5. *Spratelloides gracilis* BLEEKER. Atl. Ichth. VI. 1866 — 1872 pag. 96.
6. *Stolephorus japonicus* JORDAN and SEALE. Proc. U. S. Nat. Mus. XXVIII. 1905 pag. 770.
7. *Stolephorus gracilis* EVERMANN and SEALE. Bull. Bur. Fish. XXVI 1906 p. 53.

[1]) Part I: cf. Treubia XIII, p. 411.

8. *Stolephorus japonicus* JORDAN and HERRE. Proc. U. S. Nat. Museum XXXI 1907 pag. 629.
9. *Spratelloides gracilis* GÜNTHER, Fische der Südsee 1909 pag. 384.
10. *Spratelloides gracilis* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago Vol II 1913 pag. 21.

Spratelloides delicatulus (BENN.).

B. 6, D. 11, A. 11, P. 12, V. 8, L. l. 35 — 37, L. tr. 7.

Elongate, subcylindrical, somewhat compressed. Height 5.4, head 3.6 — 4 in length without caudal. Eye 3 in head about as long as snout. Maxillary reaching to somewhat farther than frontmargin of eye. Origin of dorsal much nearer to snout than to caudal. Anal somewhat longer than eye. Origin of ventrals nearer to anal than to pectorals. Pectorals longer than eye and snout. Caudal 5.4 in length of head and body, 33 gillrakers on lower branch of first gillarch. Back bluish. Sides and belly silverish. Fins hyaline.

12 specimens of 5 — 6.5 cm. from the Thousand Islands near Batavia. Date November 1929.

These specimens agree with the original description, but for having 11 anal rays instead of 9 and 33 gillrakers instead of about 26. These seem to be racial differences.

Furthermore I got 2 specimens from Karimon Djawa (in the midst of the Java-sea), with a length of 6 and 5 cm. Date 6 - 4 - '28. These specimens have 11 anal rays but 30 — 31 gillrakers.

One specimen from Bawean (eastern part of the Java-sea) of 4 cm. has 9 anal rays and 29 gillrakers. Date 4 - 4 - '28.

Furthermore many specimens from the Kangean Archipelago, again east of Bawean. These specimens (3 — 6.3 cm.) had 9 anal rays too and about 29 gillrakers.

Thus going from West to East we see diminuish the number of anal rays and the number of gillrakers. The differences are not sufficient to create two different species. It seems most probable that they are of a racial character.

Literature:

1. *Spratelloides delicatulus* BENNETT. Proc. Comm. Zoöl. Soc. I 1831 pag. 68.
2. *Clupea maccassariensis* BLEEKER. Journal. Ind. Arch. III 1849 pag. 72.
3. *Clupeoides maccassariensis* BLEEKER. Verh. Bat. Gen. XXIV 1852 pag. 17.
4. *Spratelloides delicatulus* GUENTHER. Cat. Brit. Mus. VII 1868 pag. 464.
5. *Spratelloides delicatulus* BLEEKER. Atl. Ichth. VI. 1866 — 1872 pag. 96.

6. *Stolephorus delicatulus* JORDAN and SEALE. Bull. Bur. of Fisheries XXV 1906 pag. 186.
7 *Spratelloides delicatulus* GUENTHER. Fische der Südsee Heft VIII 1906 p. 383.
8. *Spratelloides delicatulus* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago Vol II 1913 pag. 20.

COILIA GRAY.

Coilia lindmani BLKR.

For description and figure see HARDENBERG „Some new or rare fishes of the Indo-Australian Archipelago" Treubia Vol. XIII, 1931, page 411. One specimen, with a length of 12 cm. captured near Sunsang in the estuary of the river Musi, in brackish water of about 10 ‰. It fully agrees with the above-named description made after specimens caught in the middle-course of the same river.

Coilia macrognathus BLKR.

B. 10, D. 1 — 14, A. 83, P. 16, V. 7, L.l. 64, L. tr. 11.

Elongate and compressed body. Height 4.7, head 4.9 in length without caudal. Eye 6.3 in head. Snout prominent, somewhat longer than eye. Maxillary strong, reaching far beyond root of pectorals, with a row of alternant smaller and stronger teeth along the whole of its border. Distance origin of dorsal-snout 2.3 in distance origin of dorsal-caudal. Ventrals inserted somewhat behind origin of dorsal. Distance origin of ventral-anal 1.2 in distance origin of ventral-chin. Anal 2.1 in length without caudal. 5 free pectoral rays, surpassing origin of anal. 49 abdominal scutes, 12 of which are proventral. 22 gillrakers on the lower branch of first gillarch. Paired fins hyaline. Anterior half of dorsal and the border of anal and caudal black. Body yellowish, with a golden hue when alive.

One specimen with a length of 23 cm., 21.5 cm. without caudal. Caught in the Kumairiver, at about 10 miles from the mouth in water with a salinity of about 25‰.
Date, 1 October 1930.

This specimen differs from the original description as given by BLEEKER by the high number of anal rays (by which it resembles *Coilia grayi* RICHARDSON), by the somewhat smaller eye and by the high number of keeled scutes.

Literature:

1. *Coilia macrognathus* BLEEKER. Nat. Tijdschr. Ned. Indië III 1852 pag. 436.
2 *Coilia macrognathus* GUENTHER. Cat. Brit. Mus. VII 1868 pag. 106.
3. *Coilia macrognathus* BLEEKER. Atl. Ichth. VI 1872 pag. 138.

4. *Coilia macrognathus* VON MARTENS. Exped. nach Ost-Asien Zoöl. Teil. Band I 1876 pag. 201, 204.
5. *Coilia macrognathus* VINCIGUERRA. Catalogo d. Pesci raccolti a Borneo d. S. M. G. Doria e Dott. O. Beccari 1926 pag. 89 (620).
6. *Coilia macrognathus* WEBER and DE BEAUFORT. The Fishes of the Indo-Australian Archipelago II 1913 pag. 49.

CLUPEOIDES BLEEKER.

Clupeoides borneensis BLKR.

B. 6, D. 15 — 16, A. 17, P. 12, V. 8, L.l. 35 — 36, L. tr. 11 — 12.

Elongate, compressed. Height 4.3 in length without caudal, 5.3 — 5.4 with caudal. Head 4.3 in length, 4.8 — 5.0 with caudal. Eyes 3.0 in head, longer than snout. Chin subprominent. Maxillary reaches to below first half of eye, 2.8 — 3 in head. Origin of dorsal fin nearer to snout than to caudal. Pectorals about as long as head without snout. Ventrals opposite to dorsal. Very minute teeth on yaws and palatum, 18 — 20 abdominal scutes, 10 of which are proventral. First spine is inserted behind the pectorals. About 20 gillrakers on the lower half of the first gillarch. Colour whitish. Chin, nose, back and anal fin faintly powdered with black. Two faint black lines from dorsal to caudal. Caudal with a black margin.

Two specimens, 5.8 and 6.0 cm., found among a sample of *Corica pseudopterus* caught in the estuary of the river Musi (Sumatra) in brackish water with a salinity of about 10 $^0/_{00}$. These specimens are somewhat different from the original description given by BLEEKER, the height being somewhat lower and the maxillary somewhat longer. Furthermore the situation of the dorsal fin is more to the forward and the number of scales in the linea lateralis is somewhat less. These differences however are not sufficient to establish a new variety or species. This species, thus far known from South Borneo only, has been found now in Sumatra also.

Literature:

1. *Clupeoides borneensis* BLEEKER. Nat. Tijdschrift Ned. Indië I 1851 pag. 275.
2. *Clupeoides borneensis* GUENTHER Cat. Brit. Mus. VII 1868 p 452.
3. *Clupea (Clupeoides) borneensis* BLEEKER. Atl. Ichth. VI 1872 pag. 101.
4. *Clupeoides borneensis* WEBER and DE BEAUFORT. The Fishes of the Indo-Australian Archipelago II 1913 pag. 60.

CLUPEA L.

Clupea (Harengula) dispilonotus (BLKR.).

B. 6, D. 19, A. 17, P. 16, V. 8, L.l. 37, L. tr. 11.

Oblong and compressed. Abdominal and dorsal profile evenly convex.

Height 3.2, head 3.8 in length without caudal. Eye 3 in head, somewhat longer than snout and somewhat shorter than postorbital part of head. Maxillary reaches to below pupil. Origin of dorsal much nearer to snout than to caudal. Anal as long as dorsal and about half as high, 6.4 in length without caudal. Distance origin of ventrals-anus equal to distance anus-first rays of caudal. Origin of ventrals in the midst between snout and caudal. Scales with a few vertical lines. 15 praeventral abdominal scutes, 12 postventral. 37 gillrakers. Colour dark greenish on back, sides silvery. An ocellus at posterior end of dorsal, a second one 4 or 5 scales more backwards. A black patch between them, a similar patch behind occiput. Snout and chin dark. Dorsal and caudal blackish, other fins hyaline.

One specimen with a length of 8 cm. Fishmarket of Batavia, 17 - 2 - '30. The specimen quite agrees with the original description of BLEEKER.

Literature:

1. *Harengula dispilonotus* BLEEKER. Nat. Tijdschrift Ned. Indië III 1852 pag. 456.
2. *Clupea dispilonotus* GUENTHER. Cat. Brit. Mus. VII 1868 pag 429
3. *Clupea dispilonotus* BLEEKER. Atl. Ichth. VI 1872 pag. 112.
4. *Clupea dispilonotus* MAX WEBER. Siboga Exp. Fische 1913 pag. 9.
5. *Clupea dispilonotus* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago II 1913 pag. 69.

PELLONA C. V.

Pellona kampeni WEBER and DE BEAUFORT.

B. 6, D. 17, A. 42, P. 15, V. 7, L.l. 46, L.tr. 13.

Oblong and compresed. Upper and lower profile about evenly convex. Height 3.8, head 3.4 in length without caudal. Profile of nape straight. Eye 3.0 in head, somewhat shorter than snout. Two pairs of diverging ridges on head, the posterior portions of them about parallel. Each pair converging into one at the posterior end. Maxillary reaching to anterior half of eye, no supplemental bone in oral border. Chin very prominent. Origin of dorsal behind ventrals, a little nearer to end of snout than to caudal. Ventrals much nearer to anal than to suboperculum. Ventrals short. Anal 3 in length without caudal, its anterior part opposite to posterior half of dorsal. Scales deciduous, almost smooth. 27 abdominal scutes, 5 behind ventrals. 22 gillrakers, finely spinulated on anterior side only.

The description given above is made after a specimen with an approximate length of 16 cm (tail damaged). Kumai (South-West Borneo) 1 October 1930. Salinity of the water about 25 ‰.

Through the kindness of Dr. E. BANKS, Curator of the Sarawak Museum, I got one specimen from Muara Kebas, North Borneo. Date 5 - 6 - '96. Length about 18 cm.

Finformulae: B. 6, D. 16, A. 42, P. 15, V. 7.

Height 3.4, head 3.3 and anal 3 in length without caudal. 28 abdominal scutes, 8 behind ventrals. 21 gillrakers.

Furthermore I got a third specimen from the mouth of the Paneiriver in October 1929, caught in a fishtrap. Length 17 cm.

Finformulae: B. 6, D. 16, A. 42, P. 16, V. 7.

Height 3.3, head 3.3, anal 3 in length without caudal. 30 abdominal scutes. 21 gillrakers.

Each of my specimens agrees fairly well with the original description of WEBER and DE BEAUFORT, the chief difference being the fact, that the gillrakers are spinulated on the anterior side only and not all around as given by the authors.

Literature:

1. *Pellona kampeni* WEBER and DE BEAUFORT. The Fishes of the Indo-Australian Archipelago Vol II pag. 87, 1913.
2. *Pellona kampeni* VINCIGUERRA. Catalogo d. Pesci raccolti a Borneo 1926. pag. 87.

Family SCOPELIDAE.

SAURIDA C. V.

Saurida grandisquamis GTHR.

B. 14, D. 12 — 13, A. 11, P. 14 — 15, V. 9, L.l. 49 — 50 L. tr. 3 6 — 7.

Height 8.2 — 9.1, head 3.6 — 3.9 in length without caudal. Eye 4.5 — 4.6 in head. Eyelids moderately developed, the posterior larger than the anterior one. Interorbital space concave. Concavity extending only to some distance behind eye. Distance origin of dorsal-end of snout a little longer than distance origin of dorsal-adipose fin, its longest ray equal to distance between nostril and hindborder of operculum. Base of dorsal shorter than postorbital part of head. Adipose fin shorter than eye, situated above posterior half of anal. Pectorals somewhat longer than postorbital part of head, extending to eleventh or twelfth scale of lateral line and to the vertical through origin of dorsal. Ventrals shorter than head without snout. Distance origin of ventrals-anus equal to distance origin of ventral-nostrils. Caudal deeply forked, 5.1 in length of body and head, about equal to height of dorsal. 15 — 16 scales between occiput and head. Cheeks scaled. A conspicuous ridge along lateral line. Pointed, alternating teeth in both yaws, directed forward. Two bands of teeth on each side of palate, the inner band the shortest. Teeth on tongue and branchial arches. Blackish-greenish above, silvery below. Fist ray of dorsal and superior ray of caudal with black spots.

3 specimens from Tjiparage (North Coast of Java) with a length of 9.5 — 10 cm. Date 11 - 12 - 1930.

My specimens differ from the original description by the higher number of pectoral rays, the smaller height and the larger head. Furthermore by the concavity of the head, which extends only to some distance behind the eyes instead of to the occiput, by the shorter dorsal fin, by the pectorals which are longer and by the ventrals which are shorter than in the type. All these differences however, are of little value as my specimens are 9.5 — 10 cm. and the type specimens of GUENTHER 25—30 cm and the differences may be due to age therefore. Only the high number of pectoral-rays has perhaps some value, but not sufficient to establish a new species, the more so as my specimens from the Java-sea have been caught at a very great distance from the type-locality (Louisiade Archipelago) so that it may be a local difference only.

Literature:

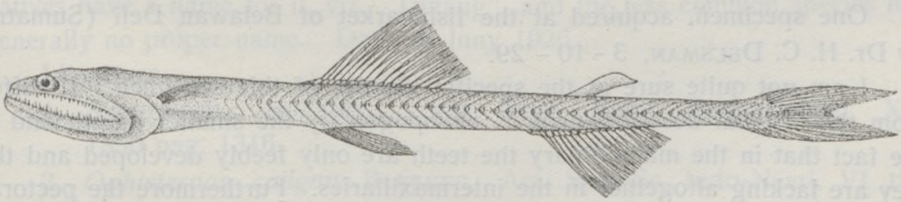
1. *Saurida grandisquamis* GUENTHER. Cat. Brit. Mus. V 1864, pag. 400.
2. *Saurida grandisquamis* GUENTHER. Challenger Rep. VI Shore Fishes 1880 pag. 50.
3. *Saurida grandisquamis* GUENTHER. Fische der Südsee 1909 pag. 377.
4. *Saurida grandisquamis* MAX WEBER. Abh. Senckenb. Naturf. Gesellsch. XXXIV 1911, pag. 22.
5. *Saurida grandisquamis* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago Vol II 1913 pag. 141.

HARPODON LESUEUR.

Harpodon mortenseni nov. spec.

B. 14, D. 13, A. 15, P. 12, V. 9, L.l. uncertain (60 — 70?).

Long slender fish, with greatest depth behind head. Height 9 in length without tail. Head 5 in length without tail. Eye 8 in head, 1.5 in snout. Distance anus-caudal 1.7 in distance anus-head. Distance origin of dorsal-eye 1.4 in distance origin of dorsal-origin of caudal. Yaws provided with strong canine-like teeth, all bent somewhat backwards. Whole visceral skeleton armed with small teeth. Vomer not toothed. Mouth opening very large. Eye situated above anterior third part of mouth. Four gills. Pseudobranch indistinct. Gillmembranes not connected with isthmus. Membranous flap of operculum reaching beyond insertion of pectoral fin,



Harpodon mortenseni, nov. spec.

which goes twice in head. Dorsal much higher than body slightly behind ventrals. Ventrals 1.5 in head. Adipose fin above anal, midway between caudal and dorsal. Caudal 6.0 total length, anal 9.0. Body naked, only lateral line and caudal peduncle with scales. Colour whitish, except the caudal fin which is powdered with black.

The above description is made after the type specimen which has a length of 8 cm. It was caught by trawl in a depth of 300 m. by Dr. Th. MORTENSEN, Copenhague, after whom the species has been named. Locality Bali Sea 8° 36′ S, 114° 34′ E. Date 7 - 4 - '29.

Together with the type specimen four other ones, 8, 9, 9 and 10.5 cm. long were captured. Examination furnished the following figures: Height 9 — 9.5, head 5.0 — 5.3, anal 9.0 in length. Distance anus-caudal 1.5 — 1.6 in distance anus-head. Eye 7 — 8 in head, about 1.5 in snout. Distance origin of dorsal-eye 1.4 — 1.6 in distance origin of dorsal-caudal. Caudal 6.3 — 6.6 in total length. D. 13 — 14, A. 15 — 16.

Family OPHICHTHYIDAE.

CIRRHIMURAENA KAUP.

Cirrhimuraena chilopogon (BLKR). (?)

Height 30 in total length, somewhat less than 3 in head. Head 10.6 in length and about 3 in trunk. Head and trunk 1.6 in tail. Eye small above the middle of cleft of mouth. Cleft of mouth 3.8 in head. Anterior nostril just behind snout in upperlip, looking downwards. Posterior nostril hidden in membranous flap of upper lip, below anterior part of eye. Three barbels between first and second nostril, seven behind second nostril. 7 pores on top of head. First pair just behind snout, second pair in the midst between eye and lip of snout. Third pair just above anterior part of eyes and the seventh unpaired pore just between posterior border of eyes. Mandibulary teeth very feebly developed. Maxillary teeth in a broad band, becoming broader posteriorly. No teeth in intermaxillaries. Pectorals situated at upper border of gillopening, 5.2 in head, longer than snout and eye. Dorsal and anal show a slight indication of becoming broader at posterior ends. Tip of tail free. Body dark above, lighter below.

One specimen, acquired at the fishmarket of Belawan Deli (Sumatra) by Dr. H. C. DELSMAN, 3 - 10 - '29.

I am not quite sure of the specific identity of this specimen. It differs from the original description of *C. chilopogon* by the smaller mouth and by the fact that in the mandibulary the teeth are only feebly developed and that they are lacking altogether in the intermaxillaries. Furthermore the pectorals are much smaller.

If we judge these differences to be of specific value then my species does not belong to one of the five known species of *Cirrhimuraena* in the Indo-Pacific. In accordance however with the uncertainty of the systematics of this genus, I think it wiser to delay the decision, whether we are dealing here with a new species or not, until more material has been collected.

Literature:

1. *Ophisurus cheilopogon* BLEEKER. Act. Soc. Sc. Indo-neerl. VIII, 1860 pag. 59.
2. *Cirrhimuraena chilopogon* BLEEKER. Atl. Ichth. IV 1864 pag. 42.
3. *Ophichthys chilopogon* GUENTHER. Cat. Brit. Mus. VIII 1870, pag. 76.
4. *Cirrhimuraena cheilopogon* MAX WEBER. Siboga Exp. Fische 1913 pag. 51.
5. *Cirrhimuraena chilopogon* WEBER and DE BEAUFORT. The Fishes of the Indo-Australian Archipelago III 1916 pag. 293.

Family **SYNBRANCHOIDAE.**

MACROTREMA REGAN.

Macrotrema caligans (CANT.).

Body naked and elongate, somewhat compressed. Head about 8½ in total length. Lips well developed. Height of head 2.4 — 2.5 in length of head. Tail 5 — 5.6 in total length. Eyes small, nearly invisible. Small posterior nostril situated obliquely above the eye. Anterior nostril near tip of snout. Cleft of mouth about 4 in length of head. Maxillary teeth small, in a single series, forming a triangular figure near symphysis, palatal teeth strong, in a single series. Mandibulary teeth strong, in a single series too, near symphysis in three or four rows. Gillmembranes united, extending upwards to lateral line, which is conspicuous and situated in upper half of body. Gillopenings form a single operture. Ventrals and pectorals absent. Dorsal and anal consisting of cutaneous folds. Dorsal about as long as anal. Caudal with 6 — 12 rays (mostly 11 — 12). Whole body lackcoloured.

10 specimens with a length of 12 — 14 cm. I got these specimens through the courtesy of Dr. H. C. DELSMAN, who had acquired them from Pemalang on the North coast of Java. They seem to be rather common there, as the natives have a name for it, viz. „Tunang", and the less common species have generally no proper name. Date 26 Juny 1926.

Literature:

1. *Synbranchus caligans* CANTER. Journ. Asiat. Soc. Bengal, XVII 1850 pag. 1316.
2. *Ophisternon caligans* BLEEKER. Act. Soc. Sc. Indo-Neerl. VI 1859 pag. 180.

3. *Symbranchus caligans* GUENTHER. Cat. Brit. Mus. VIII 1870 pag. 17.
4. *Symbranchus caligans* VON MARTENS. Preuszische Exp. nach Ost-Asien. Zoöl. Theil I 1876 pag. 405.
5. *Macrotrema caligans* TATE REGAN. Ann. Mag. Nat. Hist. IX 1912 pag. 390.
6. *Macrotrema caligans* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago III 1916 pag. 415.

Family POLYNEMIDAE.

ELEUTHERONEMA BLEEKER.

Eleutheronema tridactylum (BLKR.).

B. 7, D_1. VIII, D_2. I. 13, A. III. 15, P.l. 17 + 3 liberi, V. 1.5, L.l. 82, L. tr. 12/1/14.

Elongate. Height 4.0 in length without and 5.3 with caudal. Head 3.3 without and 4.4 with caudal. Eyes totally covered bij a gelatinous membrane, 4 in head. Snout shorter than eye, prominent and blunt. Tip of lower yaw behind nostrils, but in front of eyes. Mouth opening larger, reaching to far behind eyes. Maxillary and mandibulary scaly. Distance backend of mixillary-tip of snout 1.7 in length of head. Head scaled to tip of snout. Anterior and posterior nostrils close together, halfway between tip of snout and eye. Praeoperculum serrated, its lower angle produced and rounded. Upper lip not developed, lower lip only near corner of mouth. Each yaw with a broad villiform band of minute teeth, covering even the outer side of the yaws. Similar teeth on head of vomer and palatines. Origin of first dorsal between pectorals and ventrals. Second dorsal above anal. Distance origin of anal-caudal 1.2 in distance origin of anal-tip of snout. Anal and second dorsal totally scaly. First dorsal with a scaly sheath. Caudal 4.2 in total length, totally covered with scales. Height of second dorsal and anal about the same, as long as pectorals and longer than postorbital part of head. Second dorsal and anal concave. Pectorals falciform, three free filaments, the longest (upper) one exceeding tip of ventrals, second one somewhat shorter and third one much shorter. Caudal deeply forked, with acute lobes. Scales with crenulated hindborder. Pectorals and dorsal darkish, also the caudal, which has a black border. Back greenish, lower side of body whitish to yellowish, all with a golden hue when alive.

One specimen with a length of 13 cm. Kumai, 1 October 1930, in water with a salinity of about $25^0/_{00}$. The description given above differs only in some minor points from the original description of BLEEKER. The eyes and the pectorals in my specimen are much larger, but these differences are probably due to age as BLEEKER's type-specimen was 32 cm.

I got a second specimen, with a length of 19 cm. from the Banju-asin, one of the original finding places of BLEEKER. It showed no differences from the description given above. Date 19 - 12 - '31. Brackish water.

Literature:

1. *Polynemus tridactylus* BLEEKER. Nat. en Geneesk. Arch. Ned. Indië II 1845 pag. 524.
2. *Polynemus tridactylus* BLEEKER. Verh. Bat. Gen. XXII 1849 pag. 57.
3. *Eleutheronema tridactylum* BLEEKER Versl. en Mededeelingen Kon. Akad. Amsterdam XIV 1862 pag. 124.
4. *Polynemus tridactylus* VOLZ. Zoöl. Jahrb. Abth. Syst. XIX 1903 pag. 359.
5. *Eleutheronema tridactylum* WEBER and DE BEAUFORT. The Fishes of the Indo-Australian Archipelago IV 1922 pag. 198.
6. *Eleutheronema tridactylum* VINCIGUERRA. Catalogo d. Pesci raccolti a Borneo 1926 pag. 65.

POLYNEMUS L.

Polynemus longipectoralis WEBER and DE BEAUFORT.

B. VII, D_1 VIII, D_2 I. 16, A. II 12, P. 16 + 7 liberi, V. I. 5, L.l. 87, L. tr. 6/1/13.

Height 4.1 in length without caudal, 6 in length with caudal. Head. 3.8 and 5.5 respectively. Eyes rather small, 8.2 in head, less than snout, 5.7 in postorbital part of head. Mouth inferior, large, reaching behind eyes. Maxillary scaly. Distance back end of maxillary- tip snout 1.8 in head. Anterior and posterior nostrils close together, close to eyes. Praeoperculum finely serrated, its lower angle bluntly rounded and produced. A narrow band of very minute teeth in yaws. Similar teeth on vomer and palatines. Operculum protruded in a membranous flap, not reaching to origin of pectorals. Origin of first dorsal behind origin of pectorals and in front of origin of ventrals, spines soft and flexible, the first one minute. The longest, third one, as long as postorbital part of head. Origin of second dorsal in front of anal. Distance origin of anal-caudal 1.3 in distance origin of anal-chin. Caudal deeply forked with elongated, pointed lobes, 3.3 in total length. Dorsals, anal and caudal scaled. Pectorals pointed, surpassing origin of anal, 1.4 as long as head. The seven free filaments very conspicuously separated from the pectoral. Upper one about 2½ times as long as total length. The second one somewhat shorter, third one just exceeding tips of caudal, fourth one reaching to midst of anal, fifth one just reaching anal, sixth one surpassing anus and seventh one not reaching anus. Ventrals somewhat longer than postorbital part of head. Distance between origin of anal and origin of ventrals about as long as head. Colour greenish above, yellowish beneath. Fins hyaline to yellowish.

One specimen of 18 cm. length, taken at the fishmarket of Bandjermasin (Borneo) 1 - 5 - '30. The type-specimen was collected in the same locality by the staff of the Fisheries-steamer „Gier". Finformulae and linea lateralis as in the individual described above. Only the eyes in my specimen are much smaller, the pectorals much larger, and the lengths of the free pectoral rays do not agree with those given in the description.

Literature:

1. *Polynemus longipectoralis* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago IV 1922 pag. 213.

Polynemus sextarius BL. SCHN.

I have given a detailed description and a figure of this species in a previous paper (See HARDENBERG in Treubia Vol XIII 1931 pag. 414). Since then I got some more specimens from other localities, which quite agree with the above-named description.

One specimen, with a length of 10 cm. from the Banjuasin (near the mouth of the river Musi), 10 - 12 - '31. Seven specimens, with a length of 7.5 — 11.5 cm., from Bagan si Api Api, near the mouth of the Rokan (Sumatra), February 1932.

UEBER EINIGE MARINE PENAEIDEA (CRUSTACEA DECAPODA) DES MALAIISCHEN ARCHIPELS.

Von

HEINRICH BALSS,

(München).

Das Laboratorium voor het Onderzoek der Zee, Batavia (Director Prof. Dr. H. C. DELSMAN) hat mir eine grössere Sammlung von Penaeiden zur Bestimmung zugesandt, die neben den gewöhnlichen Formen des Indo-pacific auch einige seltenere, bisher wenig bekante Arten enthielt, sodass ich es für nützlich halte, die Liste zu publizieren. Eine neue subsp. von *Trachypenaeus curvirostris* kann ich hier zum ersten Male beschreiben, die bisherige Beschreibung von *Parapenaeopsis hungerfordi* ALCOCK durch Abbildungen ergänzen; auch ergaben sich einige neue Synonymieen.

Die Arten waren soweit ich sehe, sämmtlich im oberen Litorale gefangen.

Gattung PENEUS WEBER.

SCHMITT 1926 pg. 359. (Bestimmungsschlüssel).

Peneus semisulcatus DE HAAN.
Peneus monodon ALCOCK 1906 pg. 8 Taf. 1 Fig. 1.
„ *semisulcatus* DE MAN 1911 pg. 97 Taf. 9 Fig. 31a.
„ „ „ „ 1924 pg. 23.

Fundangaben: Viele Exemplare aus der Javasee.
Häufigste der *Peneus*-Arten der Sammlung.

Geographische Verbreitung: Von der Ostküste Afrikas (Kapregion bis Rotes Meer) bis Japan und Neu Guinea.

Peneus latisulcatus KISHINOUYE.
DE MAN 1911 pg. 108 Taf. 9 Fig. 35.
„ „ 1924 pg. 29.
SCHMITT 1926 pg. 365.

Fundangaben: 1 ♂, Gier 3 Exp. 7; 3° 26′ S. B.; 107° 5′ O. L. (Javasee).
Geographische Verbreitung: Rotes Meer bis Japan, Ost- und Südaustralien, (Kangaroo Islands).

Peneus carinatus DANA.
Peneus semisulcatus ALCOCK 1906 pg. 10 Taf. 1 Fig. 2.
„ *carinatus* DE MAN 1911 pg. 101.; 1924 pg. 24.

Fundangaben: 1 ♂, Brackwasser von Gomo Gomo, PATOT; 1 ♂, Gier 6, Exp. 10. 6° 51′ S. B., 114° 13′ O. L. (Javasee). Mehrere, bei Batavia, DELSMAN leg.
Geographische Verbreitung: Ostindien bis Japan und Malaiischer Archipel.

Peneus indicus longirostris (DE MAN).
DE MAN 1911 pg. 103; Taf. 9 Fig. 32. (Lit.).
PESTA 1915 pg. 117.

Fundangaben: 2 ♀ adult, (Länge des Carapax + Rostrum 50 mm, des Abdomens 88 mm). Bali, Boeleleng, OUWENS leg.
Geographische Verbreitung: Ostküste Afrikas, Sokotra, Vorderindien, Ceylon; Malaiischer Archipel.

Peneus merguiensis DE MAN.
DE MAN 1911 pg. 104 Taf. 9 Fig. 3.; 1924 pg. 26.

Fundangaben: 1 ♀ Gier 9 Exp. 19; 1° 3.5′ S. B., 104° 35′ O. L. Westlich Sumatra.
Viele Exemplare, Javasee.
Geographische Verbreitung: Von Vorderindien bis Philippinen, Malaiischer Archipel, Neu Guinea (Westküste).

Gattung PENAEOPSIS BATE

SCHMITT 1926 pg. 319.

Penaeopsis monoceros (FABRICIUS).
Metapenaeus monoceros ALCOCK 1906 pg. 18 Taf. 3. Fig. 7.
Penaeopsis monoceros DE MAN 1911 pg. 55; 1924 pg. 2.
Metapeneus affinis ALCOCK 1906 pg. 20; Taf. 3 Fig. 8.
Penaeopsis affinis DE MAN 1911 pg. 57. Fig. 15a.
„ „ „ „ 1924 pg. 4 Fig. 2, 2a.

Fundangaben:

a) Erwachsene, typische *monoceros*stadien:

Viele Exemplare von: Nordküste Sumatras, Nähe Berhalastrasse, Bangkastrasse, Makassarstrasse, Javasee.

b) *affinis*stadien.

Viele, Bai von Batavia, Pekalongan, Javasee, Bagan Si Api Api.

Bemerkungen: Die bisher als 2 verschiedene Arten aufgeführten Formen *monoceros* und *affinis* halte ich für Wachstumsstadien einer einzigen Art, indem *affinis* die jüngeren Stadien repräsentiert. Das zeigt einmal unser grosses Material (das ich durch japanisches Material der Münchener Sammlung ergänzen konnte); die *Monoceros*formen sind alles grosse ausgewachsene Tiere, während die *Affinis*formen kleiner sind. Auch das Studium der Literatur bestätigt meine Ansicht; es ist bisher weder DE MAN, noch PESTA oder KEMP gelungen, durchgehende, trennende Merkmale beider „Arten" aufzufinden. Es erweist sich das Längenverhältnis der fünften Pereiopoden als variabel; sodann zeigt sich, dass das typische becherförmige Thelycum des ♀ sich nur bei grossen Formen findet. Auch die geographische Verbreitung beider „Arten" fällt vollkommen zusammen.

Geographische Verbreitung: Im ganzen Indopacific, von der Ostküste Afrikas bis Japan, Australien und Hawai. Auch im Süsswasser gefunden in Mesopotamien (PESTA), Celebes (DE MAN), Queensland (HASWELL) Quellimane (Ostafrika, HILGENDORF).

Penaeopsis lysianassa (DE MAN).

NOBILI 1903 pg. 4.
ALCOCK 1906 pg. 23; Taf. 4 Fig. 11.
DE MAN 1920 pg. 103; 1924 pg. 9 Fig. 4.
PESTA 1915 pg. 106.

Fundangaben: 4 ♀ Gier 9 Exp. 8.
6 ♂ 10 ♀ Gier 9, Exp. 21. 2° 31′ S. B., 105° 48′ O. L. Bangkastrasse.
1 ♀ bei Krawang, Java.

Geographische Verbreitung: Mergui Archipel (DE MAN); Vorderindien (Orissaküste, Golf von Martaban, u.s.w.) (ALCOCK), Singapoere (NOBILI), Saigon (Siam) (PESTA), Sumatra, Bagan Si Api Api (DE MAN), Java, Samarang (DE MAN).

Penaeopsis brevicornis (M. EDW.)

ALCOCK 1906 pg. 22; Taf. 4 Fig. 10 (Lit.).
KEMP 1918 pg. 294.
DE MAN 1924 pg. 5 Fig. 3.

Fundangabe: 4 ♂ 2 ♀ Sumatra, Bagan Si Api Api.

Geographische Verbreitung: Von Mauritius bis Siam, Japan, Sumatra, Borneo.

Penaeopsis intermedia var. **anchista** DE MAN.
Penaeopsis ensis ALCOCK 1906 pg. 24.
„ „ BALSS 1914 pg. 8, Fig. 2. (nec *P. ensis* DE HAAN).
„ *intermedia anchista* DE MAN 1920, 1922 pg. 5, Taf. 1 Fig. 3.

Fundangaben: 3 ♂ 2 ♀, Gier 9 Exp. 18. 0° 14′ N. B., 104° 4′ O. L. (östlich Sumatra).

Bemerkungen: Unsere Exemplare sind erwachsen und messen bis zu 46 mm Carapax & Rostrum, 81 mm des Abdomens.

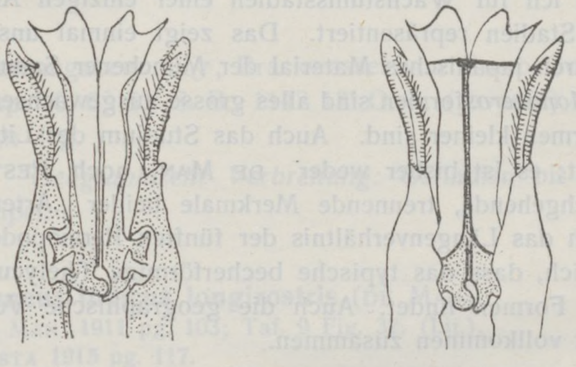


Fig. 1. Fig. 2.

Fig. 1-2. *Penaeopsis intermedia* var. *anchista* DE MAN.
1 Petasma von oben, 2 von unten.

Die Rostralbezahnung ist bei den ♂ : 9 + 1, 9 + 1, 10 + 1.
bei den ♀ : 8 + 1, 9 + 1.

Das Rostrum reicht bis ans Ende des zweiten Antennulargliedes. Beim ♂ ist der Merus des fünften Pereiopoden eingekerbt.

Vom Petasma gebe ich eine neue Figur; das Thelycum stimmt mit der von mir 1914 gegebenen überein, die sich etwas von der DE MAN'schen unterscheidet.

Synonymie: ALCOCK und *meine* Bestimmung der Form als *P. ensis* DE HAAN war unrichtig, wie sich durch die Nachuntersuchung des erhaltenen Typus DE HAAN'S (bei DE MAN l. c.) erweist.

Geographische Verbreitung: Singapore (BALSS). Indomalaiischer Archipel: Kei Inseln, Ternate, Balikpapan (Ostborneo), Puluh Weh, Bawean (DE MAN), Andamanen (ALCOCK). Die forma typica stammt von Japan; der nahe verwandte *Penaeopsis endeavouri* SCHMITT 1926 von Queensland.

Penaeopsis philippi (BATE).
Penaeopsis philippi BATE CALMAN 1923 pg. 536.
„ *coniger andamanensis* WOOD MASON et autorem.

Fundangaben: Viele ♂ und ♀, bei Krawang, Java. (Tiefe?)

Geographische Verbreitung: Philippinen, Japan (Sagamibai), Admiralitätsinseln, Andamanen, Rotes Meer, Natal. Meist in grösserer Tiefe (180 300 m).

Penaeopsis barbatus (DE HAAN).
Peneus barbatus DE HAAN 1849 pg. 192. Taf. 46 Fig. 3.
Parapeneus akayebi RATHBUN 1902 pg. 39.
„ *acclivis* RATHBUN 1902 pg. 41 Fig. 12 — 14.

Metapeneus stridulans ALCOCK 1906 pg. 27 Taf. 5 Fig. 14.
Peneus novaeguineae HASWELL (1880) 1882 pg. 204.
„ *palmensis* HASWELL (1880) 1882 pg. 204.
Penaeopsis novaeguineae SCHMITT 1926 pg. 338 Taf. 61 Fig. 1, 2a, b. (Das. weitere Lit.)
„ „ HALE 1927 pg. 39.

Fundangaben: ca 40 Stück, ♂ und ♀ in allen Altersstadien, meist aus der Javasee.

Bemerkungen: Wie schon aus den Beschreibungen bei DE MAN (1907) und SCHMITT (1926) hervorgeht, handelt es sich um eine sehr variabele Art, die aber an dem Stridulationsorgan und dem Petasma resp. Thelycum immer leicht zu erkennen ist; der älteste Name ist aber nicht, wie SCHMITT annahm, der HASWELL's, sondern der von DE HAAN 1849 gegebene, wie ich 1914 für einen Teil der obigen synonymen Arten zeigte.

Geographische Verbreitung: Rotes Meer, Vorderindien, Malaiischer Archipel, Japan, Neu Guinea, Australien, Nordwest- und Ostküste. (Vergl. SCHMITT 1926).

Gattung PARAPENEUS SMITH

SCHMITT 1926 pg. 323.

Parapeneus longipes ALCOCK.
ALCOCK 1906 pg. 33 Taf. 6 Fig. 18.
DE MAN 1911 pg. 81.

Fundangaben: 2 ♂, 1 ♀, Gier 4 Exp. 10; 5° 40′ S. B., 109° 21′ O. L. Javasee.

Geographische Verbreitung: Vorderindien, Ganjam- und Malabarenküste (ALCOCK), Javasee, Timorsee, Madurastrasse, Bai von Bima (DE MAN).

Parapeneus fissurus (BATE)
DE MAN 1911 pg. 79; Taf. 8 Fig. 25. 1922 pg. 9.
BALSS 1914 pg. 10.

Fundangaben: 9 ♂, 11 ♀, bei Krawang (bei Batavia).
1 ♂ 5 ♀, Gier 24, Exp. 5; 7° 46′ S. B., 114° 28′ O. L. (Javasee).

Bemerkungen: Sämmtliche Exemplare ermangeln des Epipoditen am dritten Pereiopoden, wie es für die Art typisch ist; auch bei sämmtlichen japanischen Exemplaren unserer Münchener Sammlung fehlt er, wie ich entgegen meiner Angabe 1914 hier richtig stellen muss.

Das Rostrum erreicht bei unseren malaiischen Formen nicht die Länge, wie es die Exemplare des Roten Meeres und Japans zeigen.

Geographische Verbreitung: Vom Roten Meere und der Kapregion (Tugelariver, STEBBING 1914) bis Japan und Neu Britannien. Meist in grösseren Tiefen (50-200 m). Im Malaiischen Archipel durch DE MAN von mehreren Orten angegeben.

Gattung PARAPENAEOPSIS ALCOCK.

ALCOCK 1906 pg. 34.

Parapenaeopsis sculptilis (HELLER).
DE MAN 1924 pg. 17 Fig. 8 (Das. Lit.).

Fundangaben: Viele Exemplare, meist ♀ von Benkoelen (Sumatra), Pekalongan (Java), Bagan Si Api Api (Sumatra), Bangkastrasse, Batavia.

Geographische Verbreitung: Ceylon (PESTA), Vorderindien (ALCOCK), Singapore (BALSS), Malaiischer Archipel (häufig, PESTA, DE MAN); Hongkong (ALCOCK).

Parapenaeopsis cornuta (KISHINOUYE).
DE MAN 1911 pg. 93 (Das. Lit.).
PARISI 1919 pg. 64 Taf. 5 Fig. 1 und 12.

Fundangaben: 1 ♂ 2 ♀, Gier 4 Exp. 20; 6° 51′ S. B., 112° 56′ O. L., Javasee.

Durch Rostrum und Petasma unterscheidet sich die Form leicht von *P. sculptilis;* dagegen ist das Thelycum beider Arten nicht unähnlich; doch ist *P. cornuta* leicht an einem Haarbüschel zu erkennen, das hinter dem Thelycum noch auf dem fünften Pereiopodensegmente median steht (Abgebildet bei ALCOCK's wohl identischer *P. maxillipedo).*

Geographische Verbreitung: Japan (Kiushiu); Formosa; Singapore; Bombay; Djankar, Java (DE MAN).

Parapenaeopsis hungerfordi ALCOCK.
ALCOCK 1905 pg. 530.
BALSS 1924 pg. 44.

Fundangaben:
1 ♀ Gier 3 Exp. 8; 6° 41′ S. B., 108° 37′ O. L. Javasee.
1 ♂ 1 ♀, Gier 9, Exp. 21; 2° 31′ S. B., 105° 48′ O. L. Bangkastrasse.
1 ♂ 2 ♀, Gier 12, Exp. 4. 3° 42′ S. B., 114° 30′ O. L. Javasee, südl. Borneo.
1 ♂ 1 ♂ Gier 9, Exp. 8.
1 ♀ Gier 4 Exp. 11; Bei Pekalongan (Nordjava).

Bemerkungen: Characteristisch für die Form ist, wie schon ALCOCK bemerkte, dass Epipoditen nur auf dem zweiten Maxillarfusse sich finden, die Pereiopoden aber derselben ermangeln.

Die Rostralcarina setzt sich bis an den Hinterrand des Carapax fort und ist in der vorderen Hälfte des Carapax in 2 gespalten.

Die Abdominalsegmente 1, 2, 3, sind glatt, während 4, 5, und 6 eine Carina tragen und die von Segment 6 hinten in einen Dorn endet. Das Telson ist auf der Oberfläche gefurcht und trägt am Ende keine Seitendornen.

Characteristisch sind ferner die Geschlechtsmerkmale; das Petasma hat ALCOCK beschrieben, aber nicht abgebildet; auch an den zweiten Pereiopoden ist eine ähnliche Bildung vorhanden, die jedenfalls bei der Spermatophorenübertragung eine wichtige Rolle spielt. (Auch bei anderen *Penaeopsis*-Arten habe ich eine solche, bisher nicht beschriebene Umbildung der zweiten Pleopoden festgestellt).

Das Thelycum ist eine schmale, längliche Platte, die seitlich in der Mitte etwas verschmälert ist und durch eine tiefe, longitudinale mediane Furche zweigeteilt ist. Hinten endet es in ein Paar von knopfartigen, behaarten Wärzchen (Fig. 5).

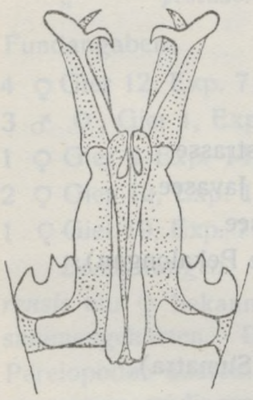


Fig. 3

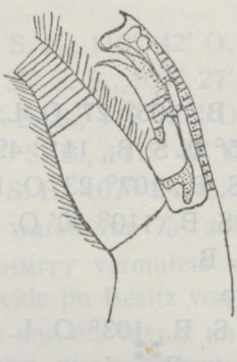


Fig. 4.

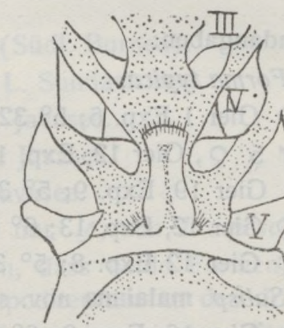


Fig. 5.

Fig. 3-5. *Parapenaeopsis hungerfordi* ALCOCK. 3-4 Pereiopoden mit Petasma, 5 Thelycum.

Der von ALCOCK schon beschriebene Dimorphismus der Rostra von ♂ und ♀ findet sich auch an unseren Exemplaren.

Mass eines ♀:

Länge des Carapax incl. Rostrum: 43 mm.
„ „ Rostrums allein: 18 mm.
„ „ Abdomens: 59 mm.
„ „ vierten Pereiopoden: 26 mm.
„ „ fünften Pereiopoden: 36 mm.
„ „ „ „ Dactylus 3 mm.
„ „ „ „ Propodus 5 mm.
„ „ „ „ Carpus 11 mm.
„ „ „ „ Merus 12 mm.
„ „ „ „ Ischium 5 mm.

Geographische Verbreitung: War bisher nur von Hongkong (ALCOCK, BALSS) bekannt.

Parapenaeopsis gracillima NOBILI.
DE MAN 1924 pg. 18 Fig. 9 (Lit.).

Fundangaben: Viele ♂ und ♀, Sumatra, Bagan Si Api Api, HARDENBERG leg.
1 ♂ 2 ♀, Gier 9, Exp. 17; 2° 38′ N. B., 102° 2′ O. L. Vor Bengkalis.
1 ♂, Gier 9, Exp. 21; 2° 31′ S. B., 105° 48′ O. L. Bangkastrasse.

Geographische Verbreitung: Borneo, Buntal (NOBILI), Singapore (BALSS); Bagan Si Api Api (DE MAN).

Gattung TRACHYPENEUS ALCOCK.

ALCOCK 1906 pg. 43.

Trachypeneus curvirostris (STIMPSON)
SCHMITT 1926 pg. 353 Taf. 63 Fig. 3 (Das. Lit.).

Fundangaben:
a) *Forma typica.*
1 ♀ Gier 1 Exp. 6; 5° 32′ S. B., 105° 27′ O. L. Sundastrasse.
1 ♂ 5 ♀, Gier 12, Exp. 15; 5° 0′ S. B., 111° 49′ O. L. Javasee.
1 ♀ Gier 19, Exp. 9; 5° 38′ S. B., 107° 23′ O. L. Javasee.
1 ♀ Gier 12, Exp. 13; 6° 15′ S. B., 110° 50′ O. L. Nähe Pekalongan).
1 ♀ Gier 12 Exp. 8; 5° 3′ S. B.
b) *Subsp.* **malaiana** nov. subsp.
1 ♀ Gier 16, Exp. 2; 6° 42′ S. B., 103° O. L. (Südl. Sumatra).
3 ♂ 3 ♀, Gier 2 Exp. 3. Bai von Batavia.
2 ♂ Gier 12, Exp. 4. 3° 42′ S. B., 114° 30′ O. L. Javasee, vor Borneo.
1 ♂ Gier 4. Vor Toeban (Nordjava).
4 ♂ 6 ♀, Gier 9, Exp. 20. 1° 20′ S. B., 104° 43′ O. L. nördl. Sumatra.
1 ♀ Gier 17 Exp. 4; 1° 36′ S. B., 109° 46′ O. L. westlich Borneo.
3 ♀ Gier 9 Exp. 21; 2° 3′ S. B., 105° 48,5′ O. L. Bangkastrasse.
2 ♂ 2 ♀, Gier 4 Exp. 20; 6° 51′ S. B., 112° 56′ O. L. Javasee.
3 ♂ 1 ♀, Gier 4 Exp. 11; Vor Pekalongan (Nordjava).

Bemerkungen: Die Arten der Gattung *Trachypeneus* werden nach der Form des Petasmas resp. Thelycums und nach dem Vorhandensein oder Fehlen von Epipoditen an den Pereiopoden 1 und 2 unterschieden (die Pereiopoden 3 haben immer Epipoditen). Es ist nun interessant, dass in dem grossen vorliegenden Materiale von *T. curvirostris* eine Reihe von Exemplaren sich finden, die, obwohl in der Form der Geschlechtsglieder vollständig mit der typischen Art übereinstimmend, doch durch den Mangel von Epipoditen an den Pereiopoden 1 und 2 sich konstant von ihr unterscheiden. Diese Formen, die ich als *subsp.* **malaiana** *nov. subsp.* zusammenfasse, liegen mir in allen Altersstadien vor; sie finden sich nur an Orten, an den die forma typica nicht gefunden wurde. Es treten auch keinerlei Variationen in der Richtung auf, dass etwa die linke Seite sich von der rechten in der Bewehrung mit Epipoditen unterschiede, oder dass ein Epipodit nur auf Pereiopod 1 oder nur auf 2

vorkäme. Das Material der Art des Münchener Museums aus Japan und dem Roten Meere zeigt diese subsp. nicht; ich muss also diese neue subsp. welche Epipoditen nur an den dritten Pereiopoden aufweist, als eine in dem Meere des Sundagebietes endemische Unterart ansehen, die wohl als Verlustmutation entstanden zu denken ist.

Geographische Verbreitung: Die typische Form der Art ist im Indopacific vom Roten Meere bis Japan und Nordost- resp. Nordwestaustralien verbreitet und häufig.

Trachypeneus salaco DE MAN.

Trachypeneus salaco DE MAN 1907 1911 pg. 90 Taf. 9 Fig. 29.

„ *pescadorensis* SCHMITT 1931 pg. 265, 267 (nicht 266) Taf. 32 Fig. 2, 3, 4.

Fundangaben:

4 ♀ Gier 12, Exp. 7; 3° 42′ S. B., 110° 42′ O. L. (Südl. Borneo).

3 ♂ ♀, Gier 1, Exp. 6; 5° 32′ S. B., 105° 27′ O. L. Sundastrasse.

1 ♀ Gier 4 Exp. 14; 6° 36′ S. B., 112° 22′ O. L. Javasee.

2 ♀ Gier 12, Exp. 15; 5° 0′. S. B., 111° 49′ O. L. Javasee.

1 ♀ Gier 19, Exp. 7; 4° 37′ S. B., 107° 24′ O. L. Javasee.

Bemerkungen: Bisher waren von *Tr. salaco* nur ♂, von *Tr. pescadorensis* nur ♀ bekannt; SCHMITT vermutete schon, dass beide Formen zusammengehörten. Da sie beide im Besitz von Epipoditen nur an den dritten Pereiopoden übereinstimmen und mir hier ♂ und ♀ von einer einzigen Station zusammen vorliegen, so wird diese Vermutung zur Gewissheit. Die Art muss also den älteren Namen DE MAN's tragen.

Nahe verwandt, wenn nicht identisch ist *Tr. granulosus* (HASWELL), den SCHMITT (1926 pg. 351 Taf. 63 Fig. 1, 2) beschrieben hat. Das ♀ unterscheidet sich nur durch das geringfügige Merkmal, dass das Thelycum in der Mediane nicht gekielt ist. Das Petasma des ♂, das SCHMITT abbildet, scheint allerdings verschieden von dem von *salaco* zu sein; doch ist es zweifelhaft, ob dieses ♂ zur Art *T. granulosus* gehört.

Geographische Verbreitung: *T. salaco* ist bisher bekannt von Lohiobai, Butonstrasse (südl. Celebes) und Kei Inseln (DE MAN), sowie Formosa (SCHMITT).

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FISH EGGS AND LARVAE FROM THE JAVA SEA [1]

by

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21. Eel eggs.

Eel eggs are fairly common in the surface catches with the egg-net. They may be recognized at once by their big size, the segmented yolk and the very spacious egg membrane. Most numerous are those without an oil-globule and which probably belong for the greater part to the many species of *Muraena* inhabiting especially the coral reefs. According to the size I first thought that three species might be distinguished among these eggs, one with a diameter of 4 mm, one with a diameter of 3.4 mm and one with a diameter of 2¾ mm. But if we look at the larvae hatching from them and especially at the numbers of the trunk- and tail-myotomes, we get the impression that they include more than three species. The number of trunk myotomes e.g. may vary between 54 and 100, showing maxima around 54, 63, 74, 83, 93 and 99. Figs. 1 - 3 relate to an egg of the smallest type, having a diameter of about 2¾ mm. and producing a larva with about 74 trunk myotomes and about 70 tail myotomes (sometimes up to 80 - 90).

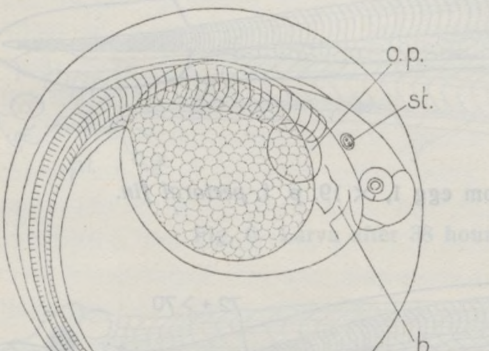

Fig. 1. Eel egg without oil globule, fished near Labuan (Sunda Strait), June 26th, 1924, 8.30 a.m. × 19. h, *heart*, o.p. *oesophageal pouch*, st. *statocyst*.

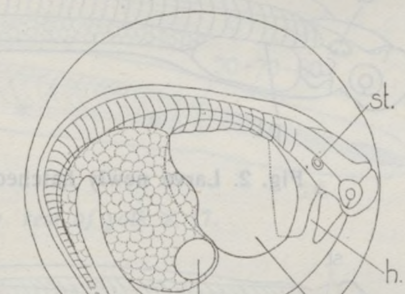

Fig. 4. Eel egg with oil-globule, diameter 2,4 mm, fished in Sunda Strait June 25 th, 1924, 7.30 a.m. × 19.

[1]) Cf. Treubia Vol. II, p. 97, Vol. III, p. 38, Vol. V, p. 408, Vol. VI, p. 297, Vol. VIII, p. 199 and p. 389, Vol. IX, p. 338, Vol. XI, p. 275, Vol. XII, p. 37 and p. 367, Vol. XIII, p. 217 and p. 401; Vol. XIV, p. 109.

We will, however, mainly deal in this article with a few kinds of Apode-eggs which contain one or more oil-globules. The development of this type of egg has been described first in 1888 by RAFFAELE [1]) in Napels and has been studied afterwards, in 1900, by EIGENMANN [2]) in Woods Hole. RAEFFAELE mentions five different kinds of eel eggs from the Bay of Napels, one of which has no oil-globule. He did not go further than alluding to the possibility that these eggs might belong to Muraenoids. This was soon after confirmed by GRASSI and CALANDRUCCIO who showed that the newly hatched larvae described by RAFFAELE have essentially the characters of the Leptocephali which have been identified by the former authors as eel-larvae.

EIGENMANN traced the development of an egg of this type containing one or a few light-yellow oil-globules and evidently closely allied to if not identical with nr. 6 of RAFFAELE. The larvae hatching from it also show the same series of black pigment patches along the gut as those reared by RAFFAELE from this egg. EIGENMANN supposes the egg studied by him belongs to the conger eel and as such it is mentioned also in EHRENBAUM'S Eier und Larven von Fischen (Nordisches Plankton). This identification has not been confirmed by later investigations. The series of black pigment patches are found again in *Leptocephalus kefersteini* KAUP and this was shown by GRASSI and CALANDRUCCIO to comprise the larvae of different species of Ophichthyids. SCHMIDT [3]), 1912, distinguished three different kinds of

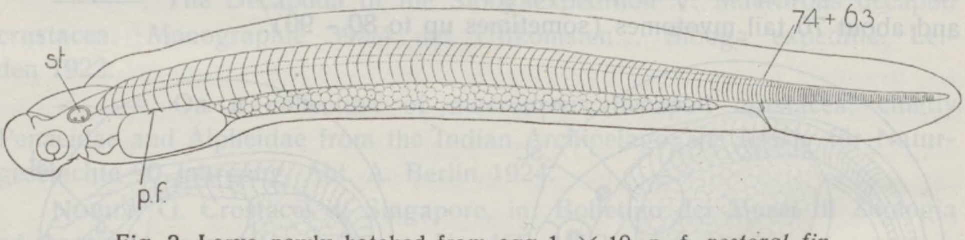

Fig. 2. Larva newly hatched from egg 1, × 19. p. f. *pectoral fin.*

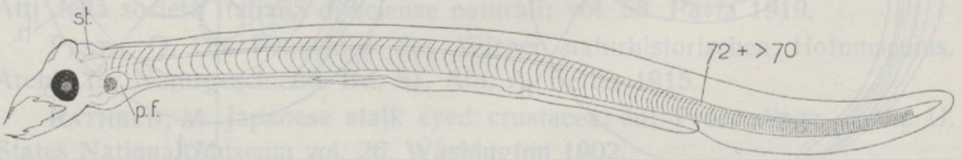

Fig. 3. Larva a few days older. × 16.

[1]) FED. RAFFAELE, 1888, Le uova galleggianti e le larve dei Teleosti nel golfo di Napoli. Mitth. Zoöl. Station Neapel, Bd. 8.
[2]) C. H. EIGENMANN, 1902, The egg and development of the Conger eel. Bulletin U. S. Fish Commission, Vol. 21.
[3]) JOHS. SCHMIDT, 1913, On the Identification of Muraenoid Larvae in their early stages. Meddelelser fra Kommissionen for Havundersögelser Serie: Fiskeri, Bd. 4.

these larvae which he attributes to *Ophichthys serpens* (= *Ophisurus serpens* LINN.), *Ophichthys hispanus* BELL.TI (= *Centrurophis remicaudus* KAUP) and *Ophichthys imberbis* (= *Sphagebranchus imberbis* DE LA ROCHE) resp.

In the surface catches made in the Java Sea similar eggs, provided with a yellow oil-globule and producing a larva with serial black pigment sports, are not rare. I have got the impression that near Java they are most numerous in and near the Straits Sunda and Bali. Two varieties may be readily distinguished, the one slightly smaller than the other.

In appearance and development they show the closest possible agreement with the eggs described by RAFFAELE and EIGENMANN This will be evident at once when looking at the figures 4 - 7. They have been made after eggs which were caught in considerable quantity on July 27th and 28th, 1921, between the southernmost Thousand Islands (north of Batavia). The diameter of the egg membrane is about 2.35- 2.45 mm., the diameter of the egg itself 1.4 mm. The yolk is segmented and contains a yellow oil-globule with a diameter of 0.3 mm. The eggs float with the oil-globule up and the embryo down.

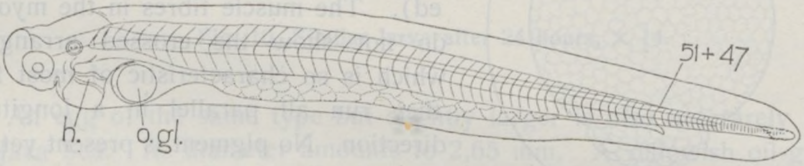

Fig. 5. Larva newly hatched from similar egg. o. gl. *oil-globule.* × 19.

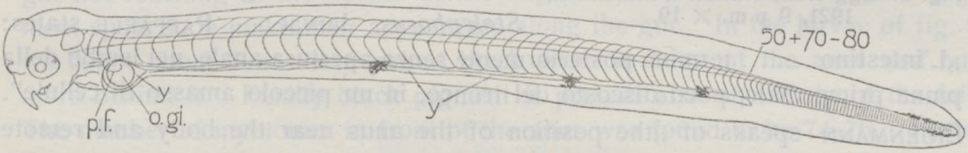

Fig. 6. Larva after 38 hours. y. *rest of yolk* × 17.

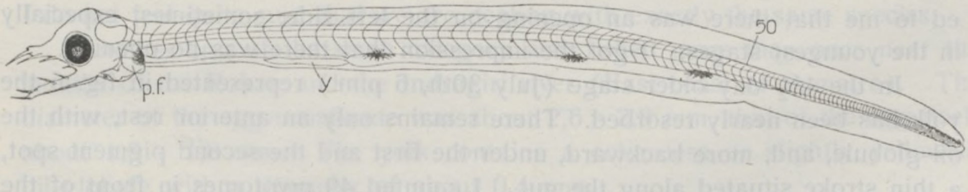

Fig. 7. Larva after 5 days. × 14.

A conspicuous feature of the embryo is the development of a voluminous, empty endodermal pouch between the pericard and the yolk-sac, the „borsa stomacale" of RAFFAELE. It is mentioned, besides bij RAFFAELE, also

by EIGENMANN who calls it the „oesophageal pouch". After the hatching of the larva it flattens out and becomes less conspicuous.

In fig. 4 we see it strongly developed. The heart in this embryo was beating at a rate of 180 pulsations per minute.

I cannot say, how long hatching takes, as the eggs fished were fairly far advanced already. Only in one of my catches did I find a similar egg with a young germinal disc (cf. fig. 8). This catch was made at 9 p.m. so that one feels inclined to suppose that spawning had taken place in the afternoon or at dawn. As this egg was found in a catch which had been fixed as a whole, it could not be reared up to make out how long development takes. At hatching the yolk assumes a much more elongated shape as shown by fig. 5. The oil-globule is always found in the most anterior part of it which is separated by a slight constriction from the rest.

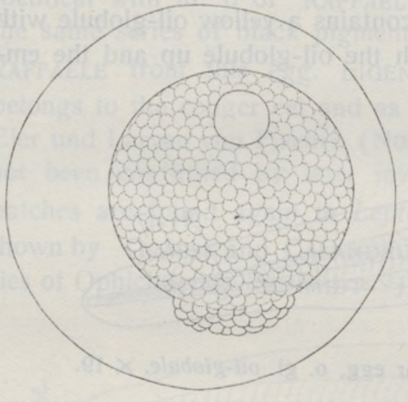

Fig. 8. Egg from station I, March 9th, 1921, 9 p.m. × 19.

In the newly hatched larva (July 29th, 6 a.m.), represented in fig. 5, I counted 51 myotomes in front of the anus and some 47 behind it (the terminal unsegmented part of the mesodern included). The muscle fibres in the myotomes do not show the crossed arrangement which is so characteristic of most fishes, they run all parallel in a longitudinal direction. No pigment is present yet. The posterior part of the gut does not reach to the border of the unpaired fin fold. We have found something similar in certain *Stolephorus* larvae. RAFFAELE states: „L'intestino .... termina posteriormente senza apertura anale, nel lembo della pinna primordiale, poco discosto del tronco, in un piccolo amasso di cellule". EIGENMANN speaks of „the position of the anus near the body and remote from the margin of the ventral fin fold". In *Stolephorus* I got the impression that there is indeed an opening, situated laterally on the fin fold. With our eel larvae I could not come to a conclusion in this respect. Sometimes it seemed to me that there was an opening on the left side, sometimes, especially in the youngest stages. I got the impression that there was no opening.

In the 1½ day older stage (July 30th, 6 p.m.) represented in fig. 6 the yolk has been nearly resorbed. There remains only an anterior rest, with the oil-globule, and, more backward, under the first and the second pigment spot, a thin stroke situated along the gut. I counted 49 myotomes in front of the anus, whereas the number of post-anal myotomes had increased to 70-80. In the larvae of about 56 days represented in fig. 7 the number of prae-anal myotomes proved to be 50 again, the number of tail myotomes was not determined.

Three paired black pigment spots are characteristic of these older larvae. Also the tip of the tail contains some black pigment.

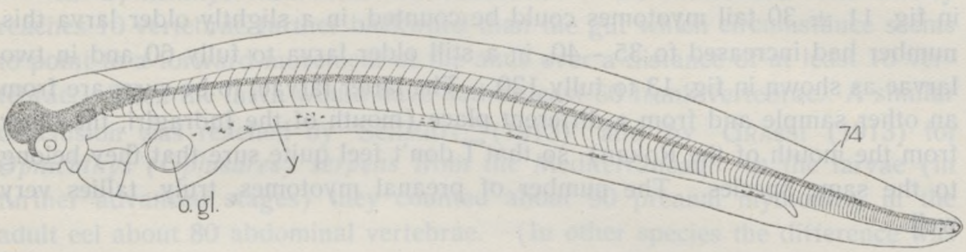

Fig. 9. Newly hatched larva from bigger egg (diameter 2,65 mm). The egg was fished east of the southern Thousand Islands, March 3rd, 1921, and hatched at 11 a.m. × 18.

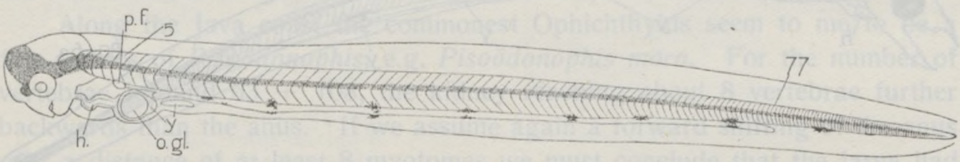

Fig. 10. Similar larva after 24 hours, × 14.

An egg of the same type but slightly larger is also not rarely found in the Java Sea. Its diameter amounts to 2,65 mm. A yellowish oil-globule is present in the segmented yolk. The larvae hatching from these eggs are shown in figs. 9 and 10. Here again we see the posterior extremity of the gut not reaching to the border of the unpaired ventral fin fold. Black pigment spots soon make their appearance along the gut. In the larvae of fig. 9 we count about 7 of these paired black spots in front of the anus and one more behind it. Finally black pigment is present also on the tip of the tail. The number of myotomes in front of the anus was found to be 74-76. In the larva shown in fig 11 it amounts to 80, whereas 63 myotomes could be counted behind the anus.

The number of pigment spots in front of the anus is here 6 only, so that I do not feel quite sure that we are dealing with exactly the same species.

Another egg of the same category was fished more than once near the mouths of the Rokan and the Indragiri river (East coast of Sumatra). The diameter of the egg-membrane was about 2,6 - 2,8 mm, that of the egg itself about 1,6 - 1,8 mm. The yolk contains a colourless or slightly yellowish oil-globule with a diameter of about 0,4 mm.

In the larva hatching from this egg 63 - 65 myotomes cculd be counted in from of the end of the gut which, here again, does not reach to the border of the unpaired fin fold. In slightly older stages I counted slightly higher numbers of prae-anal myotomes, viz. 68-70. Here again I found the tail con-

tinuing to grow out and the number of tail myotomes increasing after hatching. This seems to me a notable difference from what is found with other fish larvae, e.g. with the related clupeids. In the newly hatched larva shown in fig. 11 ± 30 tail myotomes could be counted, in a slightly older larva this number had increased to 35 - 40, in a still older larva to fully 60 and in two larvae as shown in fig. 13 to fully 120. The latter larvae, to be sure, are from an other sample and from a different place (mouth of the Indragiri, the other from the mouth of the Rokan), so that I don't feel quite sure that they belong to the same species. The number of preanal myotomes, truly, tallies very well.

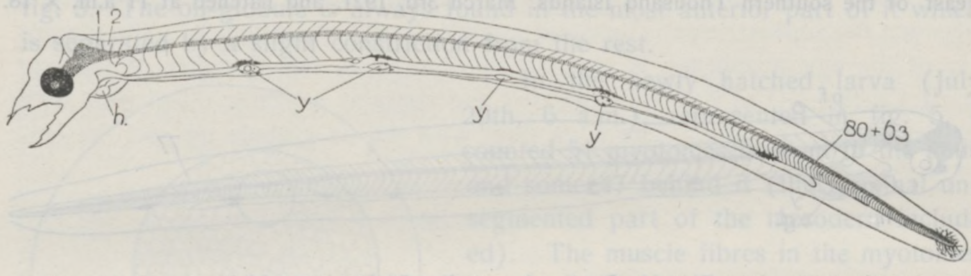

Fig. 11. Larva of two days, from a different egg catch (May 12th, 1924), × 16.

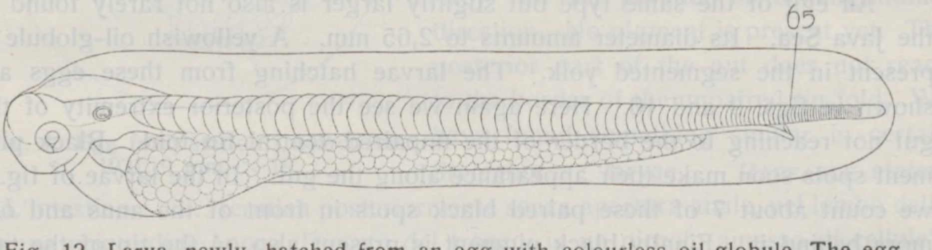

Fig. 12. Larva newly hatched from an egg with colourless oil-globule. The egg was fished near the Rokan mouth, (Sumatra) November 13th, 1923, and hatched during the night, × 19.

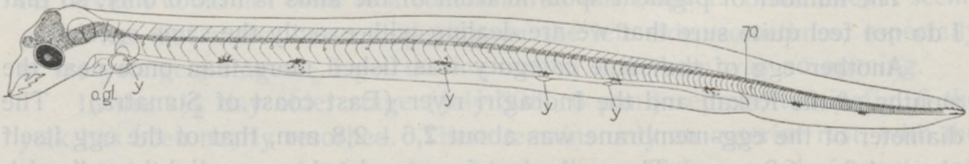

Fig. 13. Larva from similar egg fished in Amphitrite Bay (Sumatra) Sept. 27th. 1929. The larva two days after hatching, length 10 1/4 mm, × 13.

In these larvae we see again the serial black pigment spots appear which are characteristic of the larvae hatching from eel eggs with an oil-globule.

The only Ophichthyid found by my assistant Dr. HARDENBERG during

his stay at Bagan is *Ophichthys macrochir*. Besides this species only three more eels were found: two species of *Muraenesox,* and *Neenchelys buitendijki.*

In *Ophichthys macrochir* we count 50 + 94 vertebrae. The kidney reaches 10 vertebrae further backward than the gut which circumstance seems to point to a forward movement of the anus over a distance of at least 10 vertebrae. Then the larva would have had at least 60 trunk vertebrae. A similar conclusion was reached by Schmidt (1913) and by Grassi (1913) for *Ophichthys (Ophisures) serpens* from the Mediterranean. In the larvae (in further advanced stages) they counted about 90 preanal myotomes, in the adult eel about 80 abdominal vertebrae. (In other species the difference was slighter but also the identification was less reliable in the latter cases).

With all this the assumption seems to be not incompatible that the egg and the larvae of figs. 12 - 13 belong to *Ophichthys macrochir,* of course, this identification is given with some reserve [1]).

Along the Java coast the commonest Ophichthyids seem to me to be a few species of *Pisoödonophis,* e.g. *Pisoödonophis moro.* For the number of vertebrae I found 63 + 108, the kidney reaching about 8 vertebrae further backwards than the anus. If we assume again a forward shifting of the anus over a distance of at least 8 myotomes we must conclude that the larva had more than 70 trunk myotomes.

This might be, then, the larva hatching from the egg nr. 2 (figs. 8-11), but that this assumption does not rest on a very firm foundation, needs hardly be emphasized, as many more species of Ophichthyids occur in Indian waters. From the Java coast e.g. I saw *Pisoödonophis cancrivorus* and *Cirrhimuraena tapeinopterus,* but no doubt there are more, mostly leading a more or less hidden, burrowing, existence. A close investigation might even reveal the presence of species thus far unknown from here.

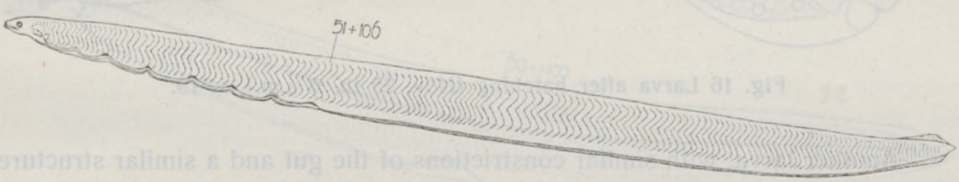

Fig. 14. Larva with beginning metamorphosis fished near Labuan (Sunda Strait), April 8 th, 1924. Length $9^{1}/_{2}$ cm.

An older *Leptocephalus* in which metamorphosis has begun, is shown in fig. 14. Numerous larvae of this kind were found among the catches made quite near the coast in shallow water by the fishermen of Labuan (Sunda Strait), April 8 th, 1924. They were mixed with „teri nassi", i.e. young,

[1]) In *Neenchelys buitendijki* Dr. Hardenberg counted 50 + 85 — 90 vertebrae, a number hardly differing from that of *O. macrochir.*

scaleless, *Stolephorus*. The length was about 95 cm. In front of the anus 51 myotomes may be counted, some 106 behind it. The gut shows a number of constrictions by which it is divided into 7 sections. The structure of the tail is conform to what we find in the adult Ophichthyids: the tip is free. The unpaired fin fold reaches ventrally from the anus to quite near the tip of the tail. Dorsally, however, it is very imperfectly developed, being found only over a very short distance in front of the tip of the tail and rapidly decreasing in a forward direction.

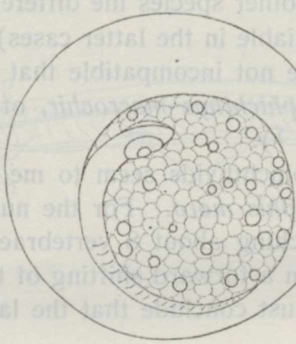

Fig. 15. Egg fished near St-Nicolaaspunt, November 24th, 1921, 8 a.m., × 19.

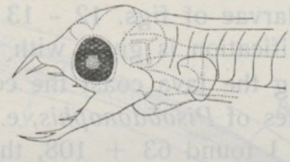

Fig. 19. Larva of 3 days, from the same sample as figs. 15 and 16, × 16.

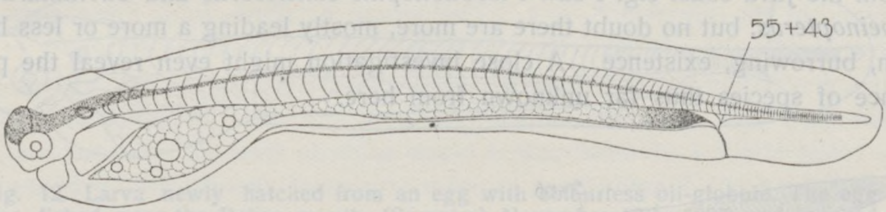

Fig. 16 Larva after hatching (Nov. 25 th, 6 a.m.), × 19.

Another larva, with similar constrictions of the gut and a similar structure of the tail, was found among the „teri nassi" at Batavia. The pigmentation, in the first mentioned larva restricted to a pigment spot over each of the constrictions of the gut (with the exception of the foremost one), is here somewhat more richly developed, scattered spots being present along the gut, the base of the anal fin and along the lateral line. The length of this larva amounted to 120 mm, in front of the anus 72 myotomes could be counted, in the tail 120. The gut was divided by constrictions into 11 sections. All these numbers are higher than in the first mentioned larva. As in the latter the dorsal fin fold is restricted to a short part of the back just in front of the tip of the tail.

Comparing these two larvae with those hatching from the two varieties of eggs described above, one is inclined to bring the former larva into relation with the smaller egg and the latter into relation with the bigger egg. The numbers of trunk myotomes tally fairly well. Those of the tail myotomes evidently increased during development. The numbers of black pigment spots and constrictions of the gut, however, do not tally unless we assume that they are not constant either and increase during development.

I will finally mention here a few other types of eel eggs found occasionally in our catches from the Java Sea.

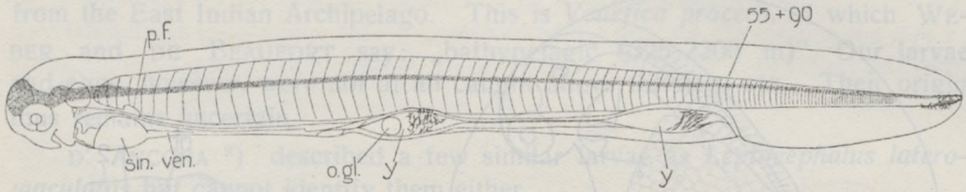

Fig. 17. Larva of 24 hours, × 15.

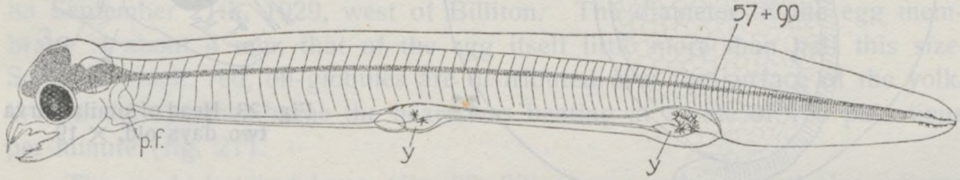

Fig. 18. Larva of fully 2 days, from an egg fished July 31th, 1921, between Pulau Kotok and P. Karang Bras. × 15.

Fig. 20. Pelagic larva caught at station N, July 25th, 1919. Length 44 mm.

The egg shown in fig. 15 was fished November 24th, 1921, near St. Nicolaaspunt (NW corner of Java) where 10 specimens were found in a haul. Diameter of the egg-membrane 2,1⁵ - 2,3⁵ mm. The yolk, segmented as usual, contains a great number of colourless oil-globules.

The next morning, November 25th, the eggs had evidently newly hatched. The larva is shown in fig. 16. The number of myotomes is 55 + 43. The yolk has assumed the usual elongated shape. The oil-globules, bigger

now but fewer in number, have assembled in the anterior part. The hindmost part of the yolk, near the anus, is conspicuous by not being segmented and by its opaqueness even in the living animal. A larva 24 hours older is that of fig. 17. Here 57 + 90 myotomes may be counted, so that the number of tail myotomes has increased considerably. The yolk has been for the greater part resorbed, the rest forming two thickenings of the gut with a thin connection between them. Black pigment is present on each of these thickenings and the anterior one contains an oil-globule. Behind the heart a spacious *sinus venosus* is to be seen. The eyes show a beginning of pigmentation. Some black pigment is present also on the tip of the tail.

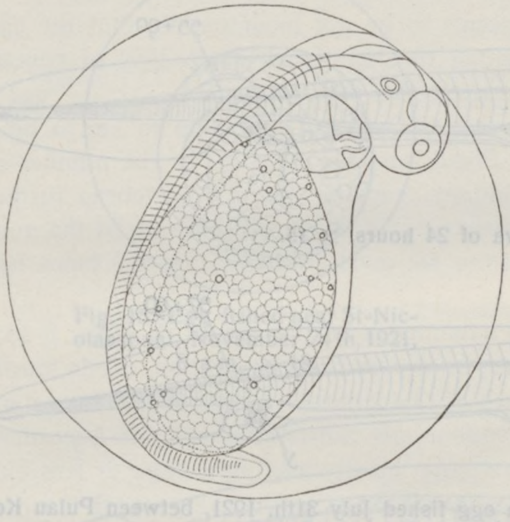

Fig. 21. Eel egg with small red oil-globules, fished on north coast of Krawang, March 19th, 1925, × 19.

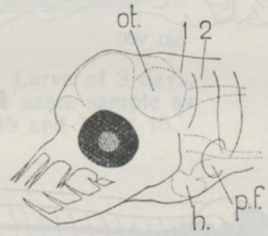

Fig. 23. Head of similar larva two days old, × 19.

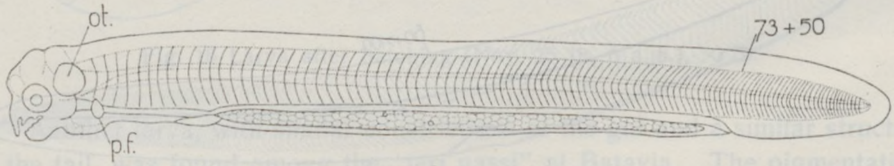

Fig. 22. Larva newly hatched from same, × 19.

The larva of fig. 18 is slightly more than one day older (fully 2 days after hatching). It hatched from an egg caught between the Thousand Islands (between Pulau Kotok and P. Karang Bras) on July 31th, 1921. The number of myotomes is 57 + 90. The remainder of the yolk consists of two small plugs above which the gut is dilated and provided with black pigment spots. The eyes are black and also the tip of the tail contains some black pigment.

The head of a larva of 3 days is shown in fig. 19. Fig. 20 shows a *Lep-*

tocephalus-larva found in a catch of station N (5°51′ S 112° 22′ E, depth 68 m) made on July 25, 1919. This larva evidently belongs to the same species, having the same two thickenings of the gut and numbers of myotomes which tally fairly well with those of the larvae described above. In front of the anus nearly 60 could be counted, behind the anus fully 100. The length of this larva amounted to 44 mm.

The two pigmented thickenings of the gut give this larva a certain likeness to one described by JOHS. SCHMIDT [1]) and which he has identified with a fair amount of certainty as belonging to *Nettastoma melanurum.* The number of myotomes in this larva is about 64 + 140.

Unfortunately there is only one representative of the Nettastomids known from the East Indian Archipelago. This is *Venefica procera,* of which WEBER and DE BEAUFORT say: „bathypelagic (325-2200 m)". Our larvae and eggs, however, were not at all caught above the deep sea. Their origin thus remains uncertain.

D' ANCONA [2]) described a few similar larvae as *Leptocephalus lateromaculatus* but cannot identify them either.

Finally I mention an egg of which two specimens were caught on March 19 th, 1925 near Tjimara (north coast of Krawang, Java) and a few more on September 21th, 1929, west of Billiton. The diameter of the egg membrane is about 4 mm, that of the egg itself little more than half this size. Some 12 small, red, oil-globules are distributed over the surface of the yolk. Within the egg-membrane the heart was beating at a rate of 150 pulsations per minute (fig. 21).

The newly hatched larva (fig. 22, 23) shows nothing particular. Some 73-76 myotomes could be counted in front of the anus, some 50 behind it.

22. Clupeoides lile (C. V.).

Whereas in nr. 7 of this series I have described the eggs and larvae of a number of *Clupea*-species, I dealt in nr. 8 with those of what I took for *Dorosoma chacunda* and of what, though hesitatingly, supposed might be *Dorosoma nasus.*

Continued observations, however, have given me the conviction that the latter two identifications are not right and need correction.

Near Labuan, as mentioned in nr. 8, I found the two kinds of eggs mixed, and afterwards I have found them mixed again in the Bay of Batavia, e.g. on March 13th, 14th and 15th, 1930. Now *Dorosoma chacunda* is a very common fish at the Batavia fish market, but *Dorosoma nasus* is never seen

[1]) JOHS. SCHMIDT, 1913, On the Identification of Muraenoid Larvae, Meddelelser fra Komm. for Havundersögelser, Serie Fiskeri, Bind IV nr. 2.

[2]) UMBERTO D' ANCONA, 1928, Murenoidi (Apodes) del Mar Rosso e del golfo di Aden. R. Comitato thalassogr. Italiano, Memoria 146.

there and seems, indeed, to be very rare in the seas of our archipelago. This makes it more improbable than ever that the second egg might be attributed to *Dorosoma nasus*.

Yet it is evident that both kinds of eggs belong to species nearly related to the genus *Clupea*. Both have the yolk in the larva rounded off at the hinder end, as is characteristic for the latter genus, and not tapering gradually into the gut, as is the case with *Engraulis, Stolephorus, Pellona* and all the other related genera as far as I know their egg and larvae.

Now, another small clupeoid is regularly found together with *Dorosoma chacunda,* viz. *Clupeoides lile*. Both species live in shallow water near the coast. It has long been a puzzle to me that I had never found the eggs of this very common little fish which at the market of Batavia is well known as t e m b a n g p u t i h, i.e. the white tembang. This name is evidently derived from the fact that it lacks the silvery hue of the common t e m b a n g *(Clupea fimbriata).*

Fig. 1. Egg fished near Gresik (Grissee), drawn at 10 a.m., × 26.

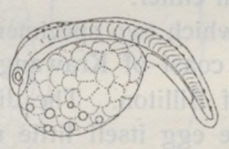

Fig. 2. Newly hatched larva 11 a.m., × 26.

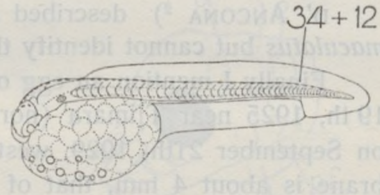

Fig. 3. Larva at 2 p.m., × 26.

The two eggs, now, described in nr. 8 evidently belong to *Dorosoma chacunda* and *Clupeoides lile*. Of these two species the latter is the smaller one and has also the lower number of trunk vertebrae. These numbers, as mentioned before (Treubia VIII p. 223), are:

Dorosoma chacunda	26 + 15 = 41
(s e l a n g e t)	25 + 16 = 41
	25 + 16 = 41
Clupeoides lile	24 + 16 = 40
(t e m b a n g p u t i h)	24 + 16 = 40
	24 + 16 = 40

The supposition, therefore, lies at hand that the smaller of the two eggs, giving rise to the larva with the lower number of trunk myotomes, belongs to *Clupeoides lile*. This is the egg and the larva formerly attributed by me to *Dorosoma chacunda*. The bigger egg then remains for *Dorosoma chacunda*. This is confirmed by observations like the following one.

Near Gresik, north of Surabaya, I found the smaller egg to be very common, together with eggs of *Coilia, Engraulis, Pellona* and a variety of *Stolephorus baganensis* (the egg mentioned in Treubia XIII. p. 239 as b from Surabaya). Here *Clupeoides lile* is a common fish whereas *Dorosoma chacunda* was not observed by us in the catches of the fishermen. Similar observations have convinced me gradually of the rightness of the interpretation given now.

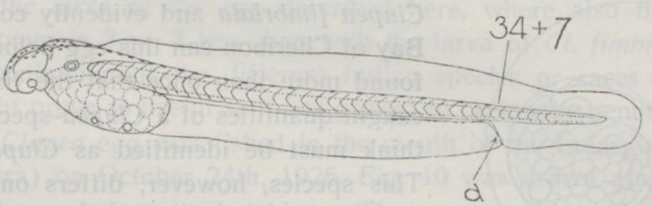

Fig. 4. Larva at the next day, 7 a.m., × 26. *a* anus, situated somewhat inside the rim of the unpaired fin fold.

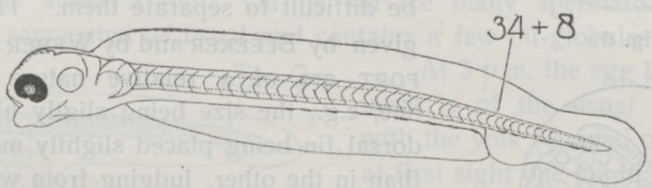

Fig. 5 Larva at the second day, 5 p.m., × 26.

The larvae hatching from the egg now ascribed by me to *Dorosoma chacunda* are much taller than those of *Clupeoides*. They even surpass in size those of *Clupea fimbriata* and equal those of *Clupea leiogaster*. The number of trunk myotomes, 37, is considerably higher than in the larva of *Clupeoides* (34). The difference (3) is greater than we might expect from a comparison of the numbers of trunk vertebrae in the adults which differ only 1-2. We come to the conclusion that in *Clupeoides* a foreward movement of the anus takes place over a distance corresponding to 10 myotomes, in *Dorosoma* over a distance corresponding to 12 myotomes. In the genus *Clupea* we found values between 9 and 11.

23. A few more Clupea-eggs.

In nr. 7 of this series I have described the eggs and larvae of a number of *Clupea*-species, i.e. those of the common t e m b a n g *(Clupea fimbriata)*. Since then I have found more than once near Cheribon eggs which make the impression of a small t e m b a n g egg and which give rise to a larva of about the same size as that of the t e m b a n g but with a lower number of trunk myotomes

The diameter of the egg membrane does not surpass 1,1 mm, whereas for the egg of *Clupea fimbriata* I found 1,4 — 1,55 mm. It contains a similar oil-globule as the latter egg, slightly smaller, however (d = 0,075 mm), and

colourless, not yellowish. Hatching occurred about noon, sometimes as early as 11 a.m., sometimes as late as 1.30 p.m., whereas in *Clupea fimbriata* it occurred only at 6 p.m. or later (cf. Treubia, Vol. VIII. p. 225). The larva hatching from this egg is hardly smaller than that of *Clupea fimbriata* and agrees in every respect with the latter but for the number of trunk myotomes which is 37 — 38 (with *Clupea fimbriata* 40).

To which *Clupea*-species closely related to *Clupea fimbriata* and evidently common in the Bay of Cheribon can this egg belong? We have found more than once that the fishermen here caught quantities of a *Clupea*-species which we think must be identified as *Clupea perforata*. This species, however, differs only very little from *Clupea fimbriata,* so that in a collection in which the two species were mixed, it would be difficult to separate them. The differences given by BLEEKER and by WEBER and DE BEAUFORT are of a relative nature only, in the one, e.g., the size being sligtly higher and the dorsal fin being placed slightly more backward than in the other. Judging from what we see in the larvae one might suppose that perhaps the numbers of trunk myotomes and vertebrae would afford a more effective means of distinguishing the two species. In an, evidently mixed, sample from Cheribon I counted from 26 to 31 trunk vertebrae whereas formerly (cf. Treubia VIII p. 222) I had found for *Clupea fimbriata* 29 — 31.

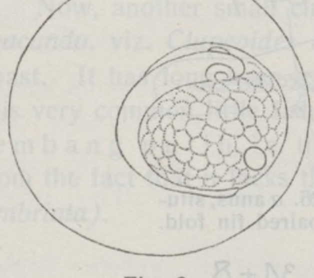

Fig. 6a

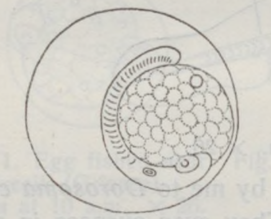

Fig. 6a and b. Eggs of *Clupea fimbriata* and of *Clupea perforata*, $\times 26$.

Now, comparing the characteristics given by WEBER and DE BEAUFORT for the two species, we find that the one looking most practicable is afforded by the difference in the number of postventral scutes, which for *Clupea perforata* is 13, for *Cl. fimbriata* 15. According to this character I divided the above sample into three groups, with 13, 14 and 15 postventral scutes resp. For the numbers of trunk myotomes I found in these 3 groups:

I (13 scutes)	26 + 16 = 42
	27 + 16 = 43
	27 + 17 = 44
	28 + 16 = 44
II (14 scutes)	28 + 16 = 44
III (15 scutes)	29 + 16 = 45
	29 + 16 = 45
	29 + 16 = 45
	30 + 15 = 45

III (15 scutes)	30 + 15 = 45
	30 + 15 = 45
	31 + 15 = 46

The latter values correspond to what I found for *Clupea fimbriata,* whereas the numbers found for the group I seem to show that there is present a related species (or race?) corresponding to *Clupea perforata* and with 2 — 3 trunk vertebrae less than *Clupea fimbriata.* This is in agreement with what we see in the larva of the egg described here, where also the number of trunk myotomes is 2 — 3 less than with the larva of *Cl. fimbriata.* A thorough reexamination of the different Indian species or races of the genus *Clupea* might prove as useful as it has proved to be for the genus *Stolephorus.*

A big *Clupea* egg was fished in the mouth of the Indragiri (Amphitrite Bay, Sumatra) on October 24th, 1926. Fig. 10 was drawn after this egg at 1 p.m., 2 hours before its hatching. The egg membrane had a diameter of 1,5 — 1,6 mm and was surrounded by a gelatinous coat of which the outer diameter was about 2 mm. On its surface many spermatozoa adhered. The yolk is segmented as usual and contains a few oil-globules.

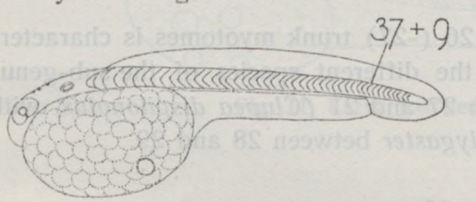

Fig. 7. Newly hatched larva of *Clupea perforata,* 2 p.m. × 26

At 3 p.m. the egg hatched. The larva is of the usual *Clupea* type, with the yolk rounded off behind. If at first sight one might have thought of a *Pellona*-egg, this view must be discarded at once as a consequence of the latter fact. In *Pellona* larvae the yolk tapers off gradually into the gut. The number of myotomes

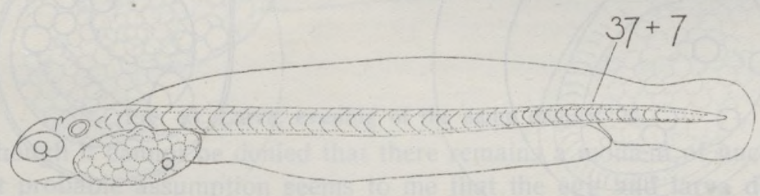

Fig. 8. A larva at the next day, 6.30 a.m., × 26.

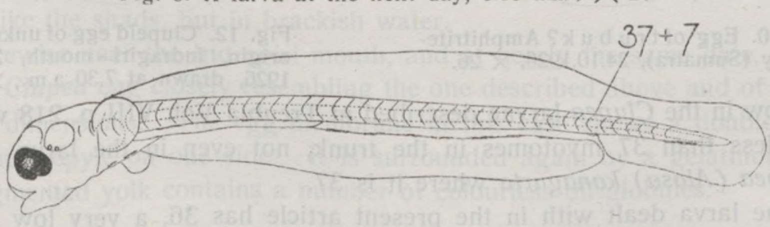

Fig. 9. A larva at the second day, 6.30 a.m., × 26.

was 36 + 6 — 7. Small black pigment spots were present on the head.

Looking for the origin of this egg one is inclined to think of a bigger *Clupea*-species with a relatively low number of myotomes and, to judge from

the oil-globules present in the yolk and from the fact that the eggs were found in water with a salinity of 2,6 — 2,8% only, a species living in brackish coast water. In this case we have to choose between *Clupea (Alosa) toli* and *Clupea (Alosa) macrura,* both known as t r u b u k and occurring near and in the river mouths of Sumatra and Borneo. The roe especially, rich of oil, is much appreciated by the consumers. These big herrings are related to the shads *(Clupea alosa, finta, sapidissima)* who shed their eggs in fresh water where they sink to the bottom.

I found the following numbers of vertebrae:

Clupea toli 26 + 16 = 42
„ „ 26 + 16 = 42
„ *macrura* 26 + 18 = 44
„ „ 27 + 17 = 44

For the related *Clupea (Alosa) kanagurta* — cf. Treubia Vol. VIII p. 222 — these numbers are

26 + 17 = 43

It seems, then, that a number of 26 (-27) trunk myotomes is characteristic for the sub-genus *Alosa.* For the different species of the sub-genus *Harengula* this number varies between 27 and 21 *(Clupea dispilonotus,* with 24!, excepted), for the subgenus *Amblygaster* between 28 and 29.

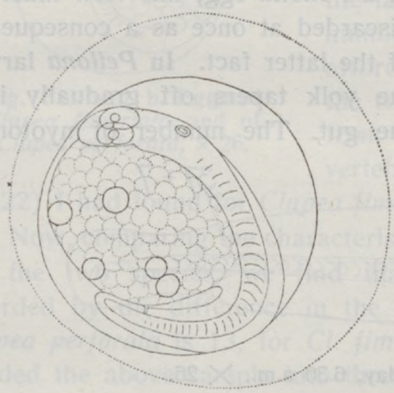

Fig. 10. Egg of t r u b u k? Amphitrite-bay (Sumatra), 24.10.1926, × 26.

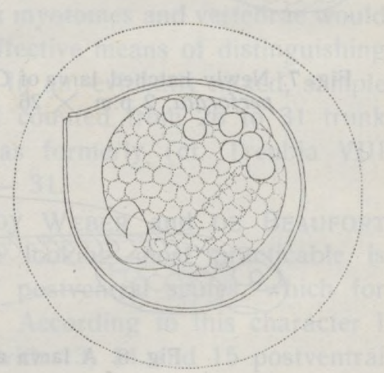

Fig. 12. Clupeid egg of unknown origin, Indragiri-mouth, 25.10. 1926, drawn at 7.30 a.m., × 26.

Now in the *Clupea* larvae described in Treubia Vol. VIII p. 218 we never found less than 37 myotomes in the trunk, not even in the larva ascribed to *Clupea (Alosa) kanagurta* where it is 37.

The larva dealt with in the present article has 36, a very low number, so that the conclusion seems warranted that it belongs to some species of the sub-genus *Alosa,* presumably to one of the trubuks.

If, however, we compare the egg with those of the shads, we do not exactly find the agreement we might expect.

According to RYDER [1]) and LEACH [2]) the egg of the American shad *(Alosa sapidissima)* has a single spacious egg-membrane with a diameter of about 3,3 mm and a yolk sac without oil-globule. According to EHRENBAUM [3]) the egg membrane is still more spacious with the European *Clupea finta,* where it attains a diameter of 4,25 — 4,6 mm, i.e. 2½ × that of the egg itself. This does not tally with what we find in the above egg. A look at the ovarial eggs of the t r u b u k, however, is sufficient to show that the yolk here is not devoid of oil but, on the contrary, contains a great amount of colourless oil-globules. The kippered ovaries of the t r u b u k are especially appreciated for their oil-contents.

In quite ripe *Clupea macrura* I found for the diameter of the ovarial egg slightly less than 1 mm.

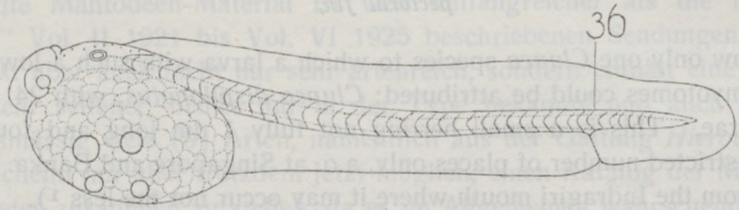

Fig. 11. Larva hatched from this egg, × 26.

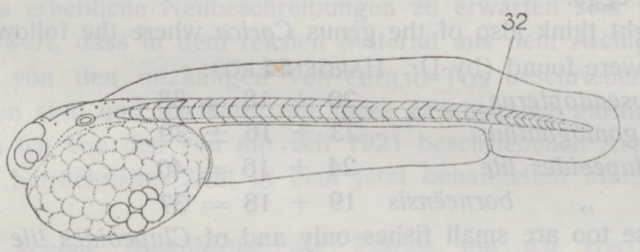

Fig. 13. Larva, evening of the same day, × 26.

Although it cannot be denied that there remains a moment of uncertainty, the most probable assumption seems to me that the egg and larva described here belong to one of the t r u b u k s which, then, would not spawn in fresh water, like the shads, but in brackish water.

Likewise near the Indragiri mouth, and at nearly the same date, I found another *Clupea* egg closely resembling the one described above and of sligthly smaller dimensions. The egg membrane in this case shows a double lining, with a micropyle on one side. It is surrounded again by a gelatinous coat. The segmented yolk contains a number of colourless oil-globules.

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1) J. A. RYDER, 1887, On the development of osseous fishes. Report of the U. S. Commissioner of Fish and Fisheries for 1885.

2) GLEN C. LEACH, 1925, Artificial propagation of shad. Appendix VIII to the Report of the U. S. Commissioner of Fisheries for 1924.

3) E. EHRENBAUM, 1894, Beiträge zur Naturgeschichte einiger Elbfische. Wiss. Meeresuntersuchungen Helgoland N. F. I.

These eggs hatched in the course of the afternoon. Fig. 13 shows a larva in the evening, fig. 14 one of the next morning. The rounded hind border of the yolk shows at once that evidently we are dealing with a *Clupea* species. The number of trunk myotomes however is exceedingly low, viz. 31 — 32.

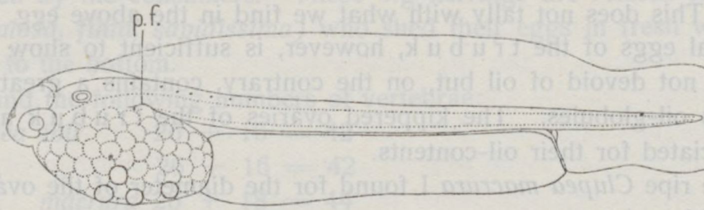

Fig. 14. Larva at the next day, 9 a.m., × 26, p. f. *rudiment of pectoral fin.*

I know only one *Clupea* species to which a larva with such a low number of trunk myotomes could be attributed: *Clupea dispilonotus,* with 24 + 15 = 39 vertebrae. This is a small herring not fully 1 dm long and found thus far in a restricted number of places only, a.o. at Singapore and Banka. I don't know it from the Indragiri mouth where it may occur not the less [1]). It seems little strange, however, that such a small *Clupea* species would have such relatively big eggs.

One might think also of the genus *Corica* where the following numbers of vertebrae were found (by Dr. HARDENBERG):

Corica pseudopterus	20 + 18 = 38
„ *goniognathus*	23 + 16 ± 39
or of *Clupeoides lile*	24 + 16 = 40
„ *borneënsis*	19 + 18 = 37

But these too are small fishes only and of *Clupeoides lile* the eggs are known already (cf. p. 248). They are much smaller.

Provisionally, then, it seems not possible to make out with any certainty or probability to wich species the last mentioned egg belongs.

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[1]) Recently one specimen was found by Dr. HARDENBERG at the fish market of Batavia.

FÜNFTER BEITRAG ZUR KENNTNIS DER MANTODEEN VON NIEDERLÄNDISCH-INDIEN [1]).

Von

F. WERNER

(Wien).

Das mir vom Zoologischen Museum in Buitenzorg zur Bestimmung eingesandte Mantodeen-Material ist weit umfangreicher als die bisher in „Treubia" Vol. II 1921 bis Vol. VI 1925 beschriebenen Sendungen.

Es ist aber auch nicht nur sehr artenreich, sondern enthält eine grössere Anzahl sehr seltener, bisher nur in der Type bekannte und auch abermals verhältnismässig viele (9) Arten, namentlich aus der Gattung *Hierodula*.

Es scheint mir aber trotzdem jetzt möglich, einen Katalog der Mantodeen des Gebietes zusammen zu stellen, da es im Allgemeinen wahrscheinlicher ist, dass im Laufe weiterer systematischer Forschungen eher Zusammenziehungen von Arten, als erhebliche Neubeschreibungen zu erwarten sein werden. Es ist bemerkenswert, dass in dem reichen Material aus dem Archipel nur äusserst wenige von den unzähligen von GIGLIO-TOS beschriebenen kleineren Arten enthalten sind und ich kann mir diese Erscheinung garnicht erklären, umsomehr als ich von den von mir seit 1921 beschriebenen Arten eine verhältnismässig beträchtliche Zahl in dem jetzt behandelten Material wiederfinde.

Für die schöne Ausführung der Photos bin ich Herrn Docenten Dr. HANS STROUHAL zu grossem Danke verpflichtet.

I. PERLAMANTINAE (s. str.).

Es besteht kein Zweifel, dass die *„Compsothespes"* von GIGLIO-TOS nicht in diese Familie gehören, mit denen sie nur durch negative Charaktere verbunden sind. Es ist möglich, dass die Familie ganz aufgelöst werden muss. (s. WERNER in „Treubia" III. 1923 p. 327).

1. **Gyromantis occidentalis** SJÖST.

♂ und ♀ von Neuguinea. Die *Gyromantis kraussii*, die ich in „Treubia" VI. 1925 p. 477 von Neuguinea verzeichnete, ist wohl sicher auf obige Art zu beziehen.

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[1]) Cf. Beiträge I-IV in: Treubia II, 1921, p. 125; III, 1923, p. 387; V, 1924, p. 259; VI, 1925, p. 476.

2. **Amorphoscelis reticulata** n. sp.
♂ Centr. O. Borneo Exp., 17. VIII. 1925, H. C. SIEBERS.
Gesamtlänge 17.5, Elytra 17.5 mm.

Pronotum mit einem abgerundeten Höcker hinter dem Vorderrand beiderseits von der Mittellinie und mit deutlichen, scharfen Mediankiel in der Metazone. Vordercoxen in den beiden basalen Dritteln der Unterseite braun, im Enddrittel gelblich, Vorderfemora gelblich, aussen etwas braun gefleckt. Tarsenglieder gelblich, am Ende braun. Mittel-und Hinterbeine gelblich, ebenso die ganze Unterseite mit Ausnahme des dunkelbraunen Abdomens. Cerci schwarz, Endglied gross, elliptisch; Elytren braun, Costalfeld schmal, dicht retikuliert; Discoidalfeld weitmaschig genetzt, die Felder rechteckig; die Adern weiss; Antennen dunkel und hell geringelt.

3. **Amorphoscelis siebersi** n. sp.
♂ Centr. O. Borneo Exp., 16. XI. 1925, H. C. SIEBERS.
Gesamtlänge 15.5, Elytren 18 mm.

Vordercoxen innen glänzend hellbraun, gegen die Basis dunkler; V. Femora hellgelbraun; V. Tarsen nicht dunkel geringelt Hittel-und Hinterbeine einfarbig gelblich.

Costalrand der Elytren dunkelbraun; ein länglicher Fleck an der Basis und ein dreieckiger etwas mehr apikalwärts (aber noch vor der Mitte) springen nach einwärts vor; Discoidalfeld blaulichweiss, die Längsadern mit vereinzelten braunen Stricheln. Abdomen unten dunkelbraun. Die Hfl. ragen nach hinten beträchtlich über die Vfl. hinaus.

4. **Amorphoscelis subnigra** n. sp.
♀ Centr. O. Borneo Exp., 16. V. 1925, H. C. SIEBERS.
Gesamtlänge 21, Elytren 16 mm. Die Paratype, auch ein vom gleichen Fundort (19. XI. 1925) ist gleich gross. Ganze Unterseite glänzend schwarz; Mittel-und Hinterbeine wie auch oben rötlich und gelblich geringelt; Tarsen auch der Vorderbeine dunkel geringelt. Kopf, Pronotum und der unbedeckte Teil des Mesonotums gelblich. Elytren dunkelgrau, opak, mit einem schwarzen Strich schief von der Mitte des Costralrandes über das Discoidalfeld apikalwärts; ein dunkler undeutlicher Fleck zwischen diesem Strich und der Spitze. Cerci schwarz, relativ kurz, Endglied breit, etwa eiförmig, Antennen nicht dunkel geringelt. Paratype mit mehr bräunlichen Elytren, Fleck vor der Spitze noch undeutlicher.

Es ist höchst unwahrscheinlich, dass diese Art etwa als ♀ zu einer der vorbeschriebenen, nur im ♂ bekannten Arten gehören sollte.

Mit ded 5 von GIGLIO-TOS aus dem indo-orientalischen Gebiete verzichneten und der von mir von den Philippinen beschriebenen *A. philippinica* sind nun 9 Arten aus der Region bekannt, gegen 17 afrikanische Arten.

5. **Metoxypilus spinosus** G. T.

♂ N. Neuguinea-Exp., Motorbivak am Rouffaer Rivier, ca. 175 m, VIII. 1926; ♀ Motorbivak, XI. 1926, W. DOCTERS VAN LEEUWEN.

Die Originalbeschreibung ist recht mangelhaft, es unterliegt aber keinem Zweifel, dass es sich um die vorliegende Art handelt. Beim ♂ sind wie beim ♀ drei Hinterhauptsdornen vorhanden, ein längerer mittlerer und zwei kurze seitliche. Costalfeld der Elytren braun, opak, an der Basis wenig erweitert; Discoidalfeld glashell, Queradern abwechselnd braun und weiss.

♀ Oberhalb des Scutellum frontale zwei spitzdreieckige Höcker nebeneinander, die nach vorn gerichtet sind (auch beim ♂). Ein kleiner Höcker weiter unten, ein grosser weiter oben einwärts vom Auge, stark gekielt, der Kiel senkrecht auf die Längsachse des Kopfes. Ausserdem die drei Hinterhauptsdornen, nebst den grossen Temporalhöckern. Pronotum an der supracoxalen Erweiterung mit deutlichem Dorn, am Rande nicht gezähnelt, von den Mediandornen der vordere der Prozone dreieckig, der hintere spitzig; in der Metazone eine dreieckige vertikale Lamelle, vorher ein ebensolcher Dorn; auf der absteigenden Kante der Lamelle ebenfalls ein Dorn.

Costalfeld der Elytren am Grunde etwas erweitert; Discoidalfeld mit schiefen dunklem Querband in der Mitte, zwischen diesem und dem Apex dunkle Flecke. Hfl. ockergelb, an der Spitze schwarz. Femora und Coxen aussen braun, die obere Lamelle des Femur dicht schief dunkel gestreift. Mittel-und Hinterfemora am Grunde etwas verdickt, dunkel punktiert und mit zwei dunklen Ringen. Supraanalplatte gross, median dachförmig gekielt, an der Basis parallel randig, Apex dreieckig.

II. EREMIAPHILINAE.

1. **Theopompula ocularis** (SAUSS.).

♀ S. Sumatra, Djambi Exp., Bangko, VII. 1925, O. POSTHUMUS.
♂ Cxtr. O. Borneo Exp., 16 und 26. XI. 1925; ♀ 9. X. 1925, H. C. SIEBERS.
♂ Ambon, 1922, F. KOPSTEIN.

2. **Theopompa servillei** (HAAN).

♂ W. Java, Kamodjang bei Garoet, 1450 m, 20. IV. 1930, M. A. LIEFTINCK; ♂ Malabar Geb., 1600 m. 1921, W. C. VAN HEURN; ♀ Res. Semarang (M. Java), Kedoengdjati, Djatiwald, 1924.

3. **Theopompa ophthalmica** (OL.).

2 ♂ Ambon, an Cocospalme, VII. 1922, F. KOPSTEIN.

4. **Theopompa tosta** STÅL.

W. Sumatra 450 m, Loeboek Sikaping, 1923 - 27, L. HUNDESHAGEN.

5. **Theopompa borneana** G. T.

♂ Centr. Ost-Borneo Exp., 13. VIII. 1925 und 11. X. 25, H. C. SIEBERS.

6. **Orthodera burmeisteri** W. M.

♂ N. Neuguinea-Exp., Motorbivak am Rouffaer Rivier, ca. 175 m, VIII. 1926, W. DOCTERS VAN LEEUWEN.

III. IRIDOPTERYGINAE.

1. **Hapalopeza tigrina** WESTW.

W. Sumatra, Loeboek Sikaping, 1923 - 1927, L. HUNDESHAGEN.

Centr. O. Borneo Exp., Ebene und Hügelland, 1 - 24. IX. 1925; Gebirge bis 1200 m, bei Long Petak, X. 1925, H. C. SIEBERS.

Diese und die folgenden vier Sunda-Arten dürften die häufigsten von den kleinen Arten der Sunda-Inseln sein.

2. **Tropidomantis tenera** STÅL.

♂ S. Sumatra, Djambi Exp., Salamoekoe, 21. VIII. 1925. O. POSTHUMUS. ♂ ♀ Karimoen Djawa Inseln, V. 1926, K. W. DAMMERMAN, und ♂ ♀ 22 - 30. XI. 1930, M. A. LIEFTINCK.

♂♀ Centr. O. Borneo Exp., 6. VIII., 20 - 23. IX., 3 - 6. X. 1925, H.C. SIEBERS.

♂ O. Soemba, Kananggar, 700 m, V. 1921, K. W. DAMMERMAN.

3. **Stenomantis novaeguineae** (HAAN).

♀ Boeroe, 1921, L. J. TOXOPEUS.

♀ Kei Inseln, Papakoela, 22. IV. 1922.

♀ Neuguinea, Fak Fak, X. 1923, H. A. v. MELL.

IV. AMELINAE.

1. **Amantis reticulata** (HAAN).

S. Sumatra, Djambi Exp., Pamenang, 30. X. 1925, O. POSTHUMUS.

W. Java, Buitenzorg, 16. IV. 1923; Buitenzorg, Bot. Garten, 21. XII. 1929 und Tjiboerial, 25. V. 1930, M. A. LIEFTINCK; O. Priangan, Singadjaja, 570 m, 18. VIII. 1928, H. H. KARNY; Depok, 17. II. und 25. IV. 1924, H. H. KARNY.

Karimoen Djawa Inseln, V. 1926, K. W. DAMMERMAN, und 23 - 30. X. 1930, M. A. LIEFTINCK.

Centr. O. Borneo Exp., Moeara Antjaloeng, 30. XI. 1925, H. C. SIEBERS.

2. **Amantis tristis** n. sp.

♀ Centr. O. Borneo Exp., Moeara Antjaloeng, 30. XI. - 1. XII. 1925, H. C. SIEBERS.

♂ Sangi u. Talaud Inseln, Goegoeti, VI. 1927, ERIE.

♂ Färbung graubraun, Vordere Coxen, Femora und Tibien innen schwarz-

braun und weisslich gebändert. Tarsen rotbraun, Mittel- und Hinterbeine hellrotbraun, Tarsenglieder am Ende dunkel. Elytren und Hfl. graubraun, beraucht.

♀ Hfl. wohl entwickelt, wie beim ♂ Hinterleibspitze überragend; dunkler als das ♂, daher Bänder der Vorderbeine nicht so deutlich, aber Pronotum mit dunkler symmetrischer Zeichnung (spitzwinkliger Fleck, Spitze nach vorn) auf der Prozone, zwei Längsstriche nebeneinander, drei im Dreieck gestellte Punkte dahinter, Seitenränder der Metazone dunkel.

Länge wie *Amantis reticulata,* der sie nächstverwandt ist.

3. **Gonypeta punctata** (HAAN).

W. Java: ♂ Buitenzorg, 7. XI. 1922, 2. IX. 1923, 24. VIII. 1924 (Lichtfang), 18. IV. 1925, H. C. SIEBERS; ♂ Buitenzorg, IV. 1923, H. H. KARNY; ♂ Buitenzorg, Goenoeng Mas, 1100 m, IV. 1929, H. DOCTERS VAN LEEUWEN.

4. **Gonypeta borneana** G. T.

W. Java: ♂ Buitenzorg, Goenoeng Mas, 1100 m, VI. 1929, H. DOCTERS VAN LEEUWEN; ♀ Palaboean Ratoe, Tjisolok, 27. VI. 1931, M. A. LIEFTINCK. ♂ Centr. O. Borneo Exp., 14, 24-25. IX. 1925, H. C. SIEBERS und Poeloe Kelai, IX-X. 1925, Kapt. BUYS.

♂ Von voriger Art durch bedeutendere Grösse, dunklere Färbung und das viel deutlichere Stigma der Elytren leicht unterscheidbar; auf Java anscheinend selten, wo die vorige Art vorwiegend auftritt.

V. COMPSOMANTINAE.

S. WERNER in Treubia, Vol. III. Livr. 3—4, 1923 p. 391).

1. **Myrcinus tuberosus** STÅL.

♀ Central O. Borneo Exp. 26. VIII. 1925, SIEBERS.

2. **Compsomantis crassiceps** (HAAN).

Centr. O. Borneo Exp., Ebene und Hügelland, 17. IX., 4 - 5. X., 25 - 26. XI. 1925, H. C. SIEBERS, und Gebirge bis 1200 m, Long Petak, 29. VIII. und I. IX. 1925.

3. **Compsomantis semirufula** (WESTW.).

♀ N. W. Soemba, Laora 100 m, IV. 1925. K. W. DAMMERMAN.

Diese Art ist seltener als die vorige. Das vorliegende ♀ ist durch die hellgraubraune Färbung und durch das grosse dunkel geränderte Stigma der Elytren von dieser leicht zu unterscheidem.

VI. SCHIZOCEPHALINAE.

1. **Euchomenella heteroptera** (HAAN).

W. Java: ♂ Buitenzorg, Tjiomas, 14. VI. 1922 und ♀ Tjiapoes, 14. X. 1922; ♂ Soekaboemi; ♂ Palaboean Ratoe, I. 1923.

Centr. O. Borneo Exp., ♂ 23. VIII., 3, 5, 11. X., und 23. XI. 1925; ♀ 10. IX. 1925, H. C. SIEBERS

2. **Euchomenella apicalis** WERNER.

WERNER, in: Zool. Meded. 1922, Deel VII, Afl. 1-2 p. 117.

N. O. Sumatra, Sikakap, Padang, 24. VII. 1926, LOEB.

VII. OXYPILINAE.

1. **Pachymantis bicingulata** (HAAN).

2 ♂ ♀ Centr. O. Borneo Exp., 11 X., 17. X., 21, 23. XI. 1925, H. C. SIEBERS.

VIII. CALIRIDINAE.

1. **Leptomantis sumatrana** G. T.

N. O. Sumatra: ? Sikakap, Padang, 27. VII. 1921, LOEB; ? Padang Sidempoean (Lichtfang), 17. X. 1928, FULMEK & KARNY.

Centr. O. Borneo Exp., ♀ Marah, 11. XI. und ♂ 20. IX., 8 und 19. X. 1925, H. C. SIEBERS.

Es ist wahrscheinlich, dass *L. sumatrana* sich nicht spezifisch von *L. albella* unterscheiden lässt. Unter dem vorliegenden Material gibt es Exemplare, bei denen die schwarze Pronotumzeichnung mehr weniger reduziert erscheint. Dagegen dürfte GIGLIO-TOS unter dem Namen *L. albella* zwei Arten vereinigt haben.

2. **Leptomantis fragilis** (WESTW.).

Centr. O. Borneo Exp., 11 - 23. IX., 5. 11. X. 1925, H. C. SIEBERS.

3. **Leptomantis albella** (BURM.).

N. O. Sumatra: ♀ Padang, Sikakap, 27. VII. 1926, LOEB.

W. Java: ♀ Buitenzorg, 29. XI. 1923 u. 18. IV. 1924, Lichtfang, H. H. KARNY; ♀ 23. IX. 1924, D. F. VAN SLOOTEN; ♂ ♀ Buitenzorg, Tjiomas, Waroeng Loa, 500 m, 22. XI. 1931, M. A. LIEFTINCK; ♂ Buitenzorg, Goenoeng Mas, 1000 m, VI. 1929; Tjimandala, Goenoeng Pantjar, ca. 500 m, XII. 1923, W. DOCTERS VAN LEEUWEN.

♀ Insel Bawean (Javasee), V. 1928, K. W. DAMMERMAN.

♀ Centr. O. Borneo Exp., 15., 16., 24. IX. 1925, H. C. SIEBERS.

♀ Talaud Inseln, Liroeng, Salibaboe, V. 1926, ERIE.

Ein ♀ einer *Leptomantis*-Art (wahrscheinlich *L. sumatrana* G. T.), mit zwei schiefen dunklen Strichen hintereinander jederseits auf der Prozone des Pronotums, trägt die Bezeichnung N. Guinea, Prauwenbiwak IX. 1920, W. C. v. HEURN. Die Gattung wäre neu für Neuguinea. Da aber von demselben Sammler auch zwei Arten von *Rhombodera,* die nur dem Sunda-Archipel angehören, von demselben Fundort mitgebracht wurden, steht es wohl ausser Zweifel, dass es sich um eine irrige Fundortsangabe handelt, die unbeachtet bleiben muss.

IX. DEROPLATYINAE.

1. **Deroplatys truncata** (GUER.).

W. Java: ♂ Tjitaroem bei Radjamandala, 350 m, 19. VI. 1931, L. J. TOXOPEUS.

♂ Centr. O. Borneo Exp., 23. IX. 1925, H. C. SIEBERS.

2. **Deroplatys trigonodera** WESTW.

2 ♀ O. Borneo Exp., 27 - 30. VII. 1925, H. C. SIEBERS.

3. **Deroplatys lobata** (GUER.).

N. O. Sumatra: ♂ Sibolangit, 2500 m, 1. II. 1924, W. DOCTERS VAN LEEUWEN.

♀ Centr. O. Borneo Exp., 10. VIII. und 10. IX. 1925, H. C. SIEBERS.

4. **Deroplatys desiccata** WESTW.

W. Java: ♂ Buitenzorg, 23. VIII. 1923.

X. MANTINAE.

1. **Mantis religiosa** L.

♀ Kleine Sunda-Inseln?

♂ N. W. Soemba, Laora, 100 m, IV., und ♂ ♀ O. Soemba, Kananggar, 700 m, V. 1925, K. W. DAMMERMAN.

2. **Statilia maculata** (THUNBG.).

♀ S. Sumatra, Djambi Exp., Goenoeng Mongko, 7. VIII. 1925, O. POSTHUMUS.

♂ Karimoen Djawa Inseln, V. 1926, K. W. DAMMERMAN.

♂ ♀ Centr. O. Borneo Exp., 6., 13., 19. XI., und Marah, 10 - 28. XI. 1925, H. C. SIEBERS.

3. **Tenodera aridifolia** (STOLL).

♂ ♀ W. Sumatra, Loeboeksikaping, 450 m, 1923 - 27, L. HUNDESHAGEN.

♂ ♀ W. Java: Kamodjang bei Garoet, 1400 m, am Licht, 21. IV. 1930, M. A. LIEFTINCK; ♂ ♀ Buitenzorg, Tjiapoes, 14. X. 1922 und Buitenzorg,

1921, W. C. VAN HEURN; O. Java: ♂ ♀ Idjen Plateau, 950 m, Blawan, VI. 1924, K. W. DAMMERMAN

♂ Insel Bawean (Javasee), V. 1925, K. W. DAMMERMAN.

♂ N. Bali, Gitgit, X. 1928, P. F. FRANCK.

♂ O. Soemba, Kananggar, 100 m, V. 1925, K. W. DAMMERMAN.

4. **Tenodera costalis** (BLANCH.).

Kei Inseln, Papakula, 22. VI. 1922.

N. Neuguinea Exp., ♂ Rouffaer Rivier, ca. 175 m, VIII., und Motorbivak, W. DOCTERS VAN LEEUWEN; Jakati Rivier, Bintoemi Baai, X. 1923, F. KOPSTEIN

5. **Tenodera australasiae** (LEACH).

♀ N. Neuguinea-Exp., Meervlakte, Motorbivak, VIII. 1926, W. DOCTERS VAN LEEUWEN.

6. **Tenodera fasciata** (OL.)

♂ ♀ N. W. Soemba, Laora, 100 m, VI; ♂ N. O. Soemba, Kambera, III.; O. Soemba, ♀ Kananggar, 700 m, V. 1925, K. W. DAMMERMAN.

♂ ♀ Talaud Inseln, Poeloentan, G. Piapi, VI. 1926, ERIE.

Ambon, Hitoe, II. 1923, F. KOPSTEIN.

7. **Tenodera blanchardi** G. T.

♀ Ambon, VI. 1922, F. KOPSTEIN.

8. **Pnigomantis medioconstricta** (WESTW.) (Fig. 1).

♀ Larve, Kleine Sunda-Inseln ?

Es ist schade, dass dieses Exemplar einer genaueren Fundortsangabe entbehrt, denn die Art ist sehr selten und anscheinend nur durch Beschreibung und Abbildung WESTWOODS bekannt.

Gesamtlänge 50 mm; Pronotum 18 mm lang, 8 breit (beide Erweiterungen gleich breit). Pronotum an den Erweiterungen deutlich gezähnelt; Femora dunkel gebändert; ebenso Tibien der Mittel-und Hinterbeine (die der Vorderbeine abgebrochen).

9. **Ephierodula heteroptera** (WERN.).

♀ Centr. O. Borneo Exp., 10. X.1925, H. C. SIEBERS.

♀ Kei Inseln, Papakula (Danske Exp.), 22. IV. 1922.

Mir ist noch kein ♀ dieser Art untergekommen, die in allen Merkmalen überaus konstant und daher leicht kenntlich ist.

10. **Hierodula vitrea** STOLL.

♂ N. O. Sumatra, Sibolangit, 8. X. 1925, FULMEK & KARNY; ♂ Westküste Sumatras, IV. 1911, P. A. OUWENS; ♂ Djambi Exp., S. Sumatra, Selemoekoe, 1925, O. POSTHUMUS.

♂ W. Java, Buitenzorg, 5. VIII. 1927.

♀ Karimoen Djawa Inseln, 22 – 30. IX. 1930, M. A. LIEFTINCK.

♂ Insel Bawean, V. 1928, K. W. DAMMERMAN

♀ Centr. O. Borneo Exp., 30. IX. 1925, H. C. SIEBERS.
♂ N. O. Soemba, Kambera, III. 1925, K. W. DAMMERMAN.

11. **Hierodula laevicollis** SAUSS.
♂♀ Ambon, VII. 1922, F. KOPSTEIN.

12. **Hierodula dyaka** WESTW.
Centr. O. Borneo Exp., 26. VIII. 1925, H. C. SIEBERS.
9 Dornen an den Vordercoxen. Länge 75 mm. Costalfeld der Elytren grün.

13. **Hierodula bipapilla** SERV.
♂ Sumatra, Padang Sidempoean, 17. X. 1925, Lichtfang, FULMEK & KARNY.
♂ W. Java, Buitenzorg, 30. IV. 1929, P. F. FRANCK.
♂♀ Karimoen Djawa Inseln, V. 1926, K. W. DAMMERMAN.
♀ N. W. Soemba, Laora, 100 m, IV; ♀ N. O. Soemba, Kambera, III. 1925, K. W. DAMMERMAN.

14. **Hierodula striatipes** n. sp.
♂ O. Java, Kediri, Teeunternehmung Penampean, 1000 m, VIII. 1920.
Kopf breit, Augen gross, gerundet, Stirnschild ungefähr trapezförmig, oben abgerundet, von den beiden Vertikalkielen nur obere Hälfte verdickt. Pronotum schlank, hinter dem Sulcus am breitesten, Vorderrand abgestutzt, Hinterhälfte parallelrandig, Seiten nicht gezähnelt. Elytren des Abdomen weit überragend, Costalfeld opak, an der Basis stark erweitert, gegen die Spitze äusserst schmal, Discoidalfeld ganz hyalin, wie die Hinterflügel. Vordercoxen mit 9 starken Dornen. Von den Discoidaldornen der Vorderfemora ist das 1. und 3. innen ganz schwarz, ebenso der erste, letzte und einer der mittleren; an der Basis des 1. und mittleren ein schwarzer Fleck. Abdomen ziemlich breit. Femora aussen und innen dunkelbraun gestreift.

Gesamtlänge	48	mm. (Abdomen stark geschrumpft).
Pronotum	18.5	mm.
Prozone des Pr.	4.1	„
Pronotumbreite	4.8	„
Kopfbreite	7.2	„
Elytren-Länge	47.5	„

15. **Hierodula dolichoptera** n. sp.
♂ Centr. O. Borneo Exp., Long Petak, 11. - 17. X. 1925, 1920 m, ENDERT.
Nächstverwandt *H. togiana* G. T. Stirnschild mit zwei nicht an der Basis verdickten Längsleisten. Metazone des Pronotums nach hinten etwas verbreitert. Elytren das Abdomen weit überragend; Costalfeld der Elytren opak, an der Basis ziemlich breit, gegen die Spitze sehr schmal. Discoidalfeld vollkommen hyalin; Vorderrand der Hfl. gelb, sonst hyalin. Vordercoxen mit 9

kleinen weisslichen Zähnen. Discoidaldornen der Vorderfemora und die grösseren Innendornen ganz schwarz; ein grosser schwarzer Fleck dicht vor dem Sulcus unguicularis. Stigma schwarz gesäumt.

Gesamtlänge	54.5	mm.
Pronotum	21	„
Prozone des P.	4	„
Elytren	54.8	„

16. **Hierodula oraea** n. sp.

♂ Sangi Inseln, Peta, V. 1924, S. LEEFMANS.

Nächstverwandt *H. pulchra, pulchripes, purpurescens.* Apikales Drittel der Vordercoxen schwarz, Trochanter mit schwarzer Längslinie; untere Hälfte der Vorderfemora von der Basis bis 2/3 schwarz, grössere Innendornen und der 1. und 5. Discoidaldorn ebenfalls schwarz, die übrigen Dornen schwarz spitzig. Ein heller Fleck auf dem schwarzen Grunde hinter dem Sulcus unguicularis. Coxaldornen klein, weiss, rundlich.

Gesamtlänge	62	mm.
Pronotum L.	21	„
„ Br.	6	„
Prozone	5	„
Elytren	47.5	„
Vorderfemora	16	„

17. **Hierodula borneana** n. sp.

♂ Centr. O. Borneo Exp., 17. XI. 1925, H. C. SIEBERS.

Nächstverwandt *H. siporana* G. T., aber bedeutend kleiner und nur 3 von den inneren Femoraldornen schwarz, näher noch der vorhin beschriebene *H. striatipes,* von der sie sich aber durch das deutlich gezähnelte Pronotum, die viel kleineren, stumpfen und zahlreicheren Dornen an den Vordercoxen, sowie das Fehlen der schwarzen Punkte an der Innenseite der Vorderfemora und der dunklen Längsstreifen derselben unterscheidet; auch ist das Costalfeld der Elytren etwas breiter.

Gesamtlänge 52, Pronotum 17, Elytren 40 mm.

Zwei Paratypen des gleichen Geschlechtes sind vom gleichen Fundorte, 27. IX., eine von Long Petak, 450 m. IX - X. 1925, ENDERT.

18. **Hierodula pygmaea** n. sp.

♀ N Neuguinea Exp., Pionierbivak, XI, 1920-I. 1921, W. VAN HEURN.

Stirnschild vorn stumfwinklig, keine Längskiele. Pronotum hinter dem Sulcus am breitesten, nach vorn verschmälert, vorn abgerundet, nach hinten stark eingezogen, gegen das Hinterende wieder etwas erweitert, seitlich deutlich gezähnelt. Abdomen stark verbreitert. Elytren breit, Costalfeld 2/5 des Discoidalfeldes grösstenteils (mit Ausnahme des Hinterrandes) opak, sehr

wenig die Hinterleibspitze überragend. Hfl. kürzer, Vorderrand und Spitze opak. Coxaldornen klein, unregelmässig, zahlreich (15). Färbung grün.

Gesamtlänge 46 (Paratype 48.5); Pronotum 18.5, 19.3, Prozone 5,5; Pronotum Breite 48.5; Elytren 27, 27. Vorderfemora 14.5, Abdomen-Breite 10.5, 9.

18a. **Hierodula longedentata,** n. sp.

♀ Karimoen Djawa Inseln, V. 1926, K. W. DAMMERMAN.

Nächtsverwandt *H. striata* G. T. aber Pronotum bedeutend breiter, am ganzen Seitenrande stark gezähnelt; Stigma ohne Punkte; die schiefen Adern des Discoidalfeldes des Pronotums typisch, nicht durch hyaline Zwischenräume getrennt. Vordercoxen mit 10 — 12 Dornen, die lang und spitzig sind, apikalwärts an Länge zunehmen. Trochanter an der Spitze etwas gebräunt. Discoidaldornen und vergrösserte Innendornen der Vorderfemora nicht schwarz, sondern nur gebräunt, und zwar vollständig. Abdomen breit, Färbung grün, Coxaldornen weiss.

Gesamtlänge	62	mm.
Pronotum	6.5 + 16.5	„
Breite	8	„
Elytren	4.5	„
Costalfeldbreite	5	„

19. **Hierodula (Rhombodera) maior** SAUSS.

♂ W. Java, Kamodjang bei Garoet, ca. 1200 m, VI. 1923, H. C. SIEBERS.

20. **Hierodula (Rhombodera) lingulata** STÅL.

♂ N. Neuguinea Exp., Prauwenbivak 1920, W. C. VAN HEURN.

Da *Rh. flava* (HAAN), die ich aus Autopsie kenne, von *lingulata* sicher verschieden, das ♂ von *major* SAUSS., aber viel grösser ist, so stelle ich dieses Exemplar zu dieser Art, von der das ♂ noch nicht bekannt zu sein scheint. Sie ist ebensowenig wie *Rh. basalis* bisher von Neuguinea bekannt gewesen. Da sowohl diese Art, wie *lingulata* von dem gleichen Sammler stammen, so ist die Möglichkeit nicht von der Hand zu weisen, dass beide Exemplare von Java stammen und irrtümlich mit „Neuguinea" etikettiert wurden. Das würde freilich die betr. Fundortsangaben aus Neuguinea diskreditieren!

21. **Hierodula (Rhombodera) sjöstedti** WERN.

WERNER in: Arkiv för Zoologi 21 A 1930 No. 34 p. 5, Taf. I. fig. 5.

♀ Tenimber Ins., Saumlaki, V. 1924, F. KOPSTEIN.

(7 Coxaldornen, sonst typisch).

21. **Hierodula (Rhombodera) basalis** HAAN.

♀ W. Sumatra, Loeboek Sikaping, 450 m, 1923 - 27, L. HUNDESHAGEN; ♂ W. Sumatra, Padang, Sikakap, 27. VII. 1926; ♀ S. Sumatra, Djambi Exp., Bivak Selemoekoe, 13. X. 1926, O. POSTHUMUS; ♂ Djambi, VII. - XI. 1929, C. H. TER LAAG.

♀ W. Java, Buitenzorg, 2. VIII. 1924; Tjiandjoer (Tjiserah); ♀ Soekaboemi, 1926; ♂ O. Java, Idjen Plateau, Blawan, 950 m, V. 1929, K. W. DAMMERMAN.

♂ Centr. O. Borneo Exp., 12. X. 1925, H. C. SIEBERS.

♂ N. Neuguinea Exp., Prauwenbivak, 1920, W. C. VAN HEURN.

Der letztgenannte Fundort aus Neuguinea wäre meines Wissens der erste ausserhalb der indoorientalischen Region für diese Art. Doch hege ich begründeten Zweifel an der Richtigkeit der Fundortsangabe.

22. **Hierodula (Parhierodula) sternosticta** W.-M.

N. Neuguinea Exp., ♂ ♂ Mamberamo Rivier, Albatrosbivak, VII, und ♀ Hoofdbivak, ca. 250 m, IX. 1926, W. DOCTERS VAN LEEUWEN; ♀ Pionierbivak, 1920, W. C. VAN HEURN.

23. **Hierodula (Parhierodula) schultzi** G. T.

N. Neuguinea Exp., ♂ ♂ Explor. Bivak, ca. 700 m, X., und Rouffaer Rivier, ca. 175 m, VIII., 1926, W. DOCTERS VAN LEEUWEN; ♀ Pionierbivak, 1920, W. C. VAN HEURN.

24. **Hierodula (Parhierodula) venosa** OL.

♀ W. Java, Baai v. Batavia, Insel Edam, XII. 1921.

25. **Hierodula (Parhierodula) sorongana** G. T.

♂ N. Neuguinea Exp., Albatrosbivak, VI. 1926, W. DOCTERS VAN LEEUWEN. Länge nur 53 mm, Pronotum 18, Elytren 40 mm. Das ♂ war noch nicht bekannt.

26. **Hierodula (Parhierodula) microdon** n. sp.

♂ Borneo (BLANCHEMANCHE).

Prozone des Pronotums fast 3 mal so lang wie die Metazone, nach vorn ziemlich spitz zulaufend, am Vorderende aber abgerundet. Metazone hinter der wenig entwickelten supracoxalen Erweiterung allmählich verschmälert, gegen das Hinterende aber wieder etwas erweitert. Vordercoxen fast am Hinterrand der Metazone des Pronotums erreichend, mit 7 kleinen, rein weissen Dornen, die von der Prämarginalfurche entspringen. Vorderfemora innerseits an der unteren Hälfte orangegelb, grössere Dornen und Discoidaldorn 1 und 3 ganz schwarz, die übrigen mit schwarzen Spitzen. Costalfeld der Vfl. lebhaft grün, opak; Stigma langgestreckt, elfenbeinweiss; Discoidalfeld fast vollkommen hyalin. Hfl. hyalin, nur Costalrand grün, opak.

Gesamtlänge	48	mm (Abdomen stark geschrumpft, vielleicht unvollständig)
Pronotum	20	„
Prozone	5.5	„
Breite des Pr.	6	„

(Vfl. u Hfl. stark beschädigt).

27. **Hierodula (Tamolanica) aruana** WESTW.

♀ Kei Inseln, Soengar, Wokam, 21. IV. 1922, H. C. SIEBERS.

28. **Hierodula (Tamolanica) tamolana** BRANCS.

♂ ♂ N. Neuguinea Exp., Rouffaer Rivier, ca. 175 m, VIII., und Albatrosbivak am Mamberamo, XII. 1926, W. DOCTERS VAN LEEUWEN; ♂ Pionierbivak, I. 1921, W. C. VAN HEURN.

29. **Gretella gracilis** WERNER.

♂ O. Java, Idjen Plateau, Ongop-Ongop, 1150 m, 14. V. 1924, K. W. DAMMERMAN.

Von dieser zarten Mantide liegt mir ein ♂ vor, dass sehr gut mit der Originalbeschreibung übereinstimmt. Auffallend sind die braunen Streifen an den Queradern des Discoidalfeldes des Elytren. Ich möchte bei dieser Gelegenheit bemerken, dass der stark verlängerte Discoidaldorn der Vorderfemora nicht der 1. (basale) sondern der 3. (proximale) ist.

Dimensionen: Gesamtlänge 48, Pronotum 15.5, Elytren 35 mm. Trotzdem die Gattung nach der Bestimmungstabelle von GIGLIO-TOS in der Nähe von *Statilia* zu suchen wäre, ist sie doch der Gattung *Hierodula* näher verwandt.

Ein zweites ♂ ist kleiner (42 mm), Adern des Discoidalfeldes der Elytren nicht braun gesäumt. (W. Sumatra, 410 m, Loeboek Sikaping 1923 - 1927, L. HUNDESHAGEN).

XI. EPAPHRODITINAE.

1. **Parablepharis kuhlii** (HAAN).

♂ ♀ Centr. O. Borneo Exp., 3., 7., 11. X. 1925, H. C. SIEBERS.

XII. ACROMANTINAE.

1. **Ephippiomantis ophirensis** WERN. (Fig. 2).

WERNER, in: Zoöl. Meded. 1922, Deel VII, Afl. 1 - 2, p. 123.

♂ ♂ Centr. O. Borneo Exp., 1200 m, bei Long Petak, 15 - 20. X. 1925, H. C. SIEBERS.

Es schienen bis jetzt nur ♂ ♂ bekannt zu sein. Die Exemplare stimmen in jeder Beziehung untereinander und mit der Beschreibung überein.

2. **Rhomantis moultoni** G. T.

♂ ♂ von Central O. Borneo, 20. IX., 4. X. 1925. H. C. SIEBERS.

Apex des Vorder Femur innen mit schwarzem Querband, das von zwei weisslichen, ebenso breiten Bändern eingefasst wird. Costalfeld der Elytren grünlichweiss, opak; Discoidalfeld stark beraucht, glänzend. Coxaldornen 5 — 6.

3. **Acromantis australis** SAUSS.

♂ ♀ N. Neuguinea Exp., Albatrosbivak am Mamberamo, VI. und Rouffaer Rivier, ca. 175 m, VIII. 1926, W. DOCTERS VAN LEEUWEN.

♂ Pronotum seitlich deutlich gezähnelt; Costalfeld der Elytrenu. Discoidalfeld hyalin, Hinterflügel am Distalende des Vorderrandes und an der Spitze dunkelbraun; Mittel-und Hinterbeine dunkel gebändert.

♀ Costalfeld der Elytren grün; Discoidalfeld dunkelbraun beraucht, mit dunklen schiefen Querbinden; Hfl. braun, an der Basis gelb. Pronotum seitlich stark gezähnelt.

Acromantis westwoodi G. T.

♂ O. Java, Kediri, Teeunternehmung Penampean, 1000 m, VIII. 1920.

♂♂ ♀ ♀ Centr. O. Borneo Exp., 15. VIII., 14. X., 16. XI. 1925, H. C. SIEBERS.

♂ Sangi & Talaud Inseln, Poeloentan, G. Piapi, VI. 1925, ERIE.

♂ Stirnschild spitzdreieckig ausgezogen. Pronotum in der vorderen Hälfte oder auch in der hinteren gezähnelt. Färbung gelbbraun. Grössere Innendornen der Vorderfemora schwarz.

Costalfeld der Elytren gelb, Discoidalfeld hyalin, Costalfeld der Hfl. und Aussenrand bräunlich. Mittel-und Hinterbeine dunkel quergebändert. Vordercoxen unbedornt.

♀ Coxaldornen 7 — 5. Von den dunklen Querbändern des Discoidalfeldes der Elytren, die etwa commaförmig sind, das 3. am deutlichsten, die apikalen undeutlich.

Dimensionen: ♂ 19 - 22, Pronotum 6 - 6.5, Elytren 16 - 17.
♀ 24.5 - 26.5, Pronotum 8 - 8.5, Elytren 19 - 21.5.

Anaxarcha graminea STÅL.

Oligomantis parallela WERN. Arkiv för Zoologi, Bd. 21A. No. 34, p. 6 Taf. 2, fig. 1 (♀).

♂ Centr. O. Borneo Exp., 1200 m, bei L. Petak, 15. X. 1925, H. C. SIEBERS.

Von der Type, die ein ♀ ist, unterscheidet sich das ♂ durch das nach aufwärts spitzzulaufende Scutellum frontale, die unbewehrten Vordercoxen, das grüne, nicht gelbe Costalfeld der Elytren. Pronotum von der Erweiterung an schwarz gesäumt.

Gesamtlänge 27, Pronotum 9, Elytren 21 mm.

Ambivia popa STÅL.

♀ M. Java, Kedoengdjati, 50 m. 25. VI. 1923, L. G. E. KALSHOVEN.

XIII. VATINAE.

1. **Ceratocrania macra** WESTW.

♂ ♂ Centr. O. Borneo Exp., 16. 20. VIII. 1925; ♀ 14. XI. 1925, H.C. SIEBERS.

Der Stirnschild ist nicht dreieckig, sondern wie bei *Phyllothelys* fünfeckig, höher als breit. Die beiden Gattungen stehen sich so nahe, dass es ganz unangebracht ist, sie in weit getrennten Familien unterzubringen, wie GIGLIO-TOS es tut. Ich möchte sie lieber zu den Hymenopodiden stellen.

XIV. TOXODERINAE.

Mesomicropus n. g.

Augen abgerundet, mit deutlich abgesetzter kurzer Spitze. Pronotum gerade, in der Prozone mit zwei stumpferen Kielen, Metazone dachförmig gekielt. Mittelbeine sehr kurz und wie die Hinterbeine mit leistenförmig erhöhten Längskielen der Tibien, ohne Lappen der Femora. Geniculardornen sehr kurz. Cerci lang, schmal, abgeplattet, gegen das Ende verbreitert, quer abgestutzt, kaum merklich ausgerandet. Flugorgane wohl entwickelt, das 4. Abdominalsegment etwas überragend.

1. **Mesomicropus anoplonotus** n. sp. (Fig. 3).

♂ O. Java, Res. Kedoe, Tjipiring bei Kendal, 5. VI. 1932, VAN DER MEYDEN.

Oberhalb der grossen vorspringenden Ocellen ein kleines, am Ende zweispitziges Horn. Pronotum langgestreckt, verstreut granuliert, seitlich stark gezähnt. Zwischen den beiden Längswulsten der Prozone ein nach hinten gegabelter schmälerer Kiel. Endglied der Cerci rechteckig, etwa 3 mal so lang wie der vorhergehende.

Vordercoxen mit sehr feinen Dornen. Vorderfemora etwas concav, sehr schlank. Vordertibien am Ende etwas verdickt, Dornen von der Basis zum Apex immer grösser und mehr genähert.

Färbung gelbbraun; Elytren an der Basis dunkelbraun gefleckt, im grösseren Teile mit kleinen, braunen Längsflecken. Hinterflügel an der Basis mit grossem, schwarzen blauschillernden Fleck, Vorderrand gefleckt, Spitze dunkel, Queradern im Analfeld abwechselnd dunkel und glashell.

Dimensionen:

Gesamtlänge	110	mm.
Pronotum	35	„
Metazone	26	„
Elytren	52	„
Vorderfemur	17.5	„
Mittel „	11.5	„
Hinter „	15	„
Cerci „	9.5	„

Dazu möchte ich noch hinsichtlich der systematischen Stellung der Toxoderinen Folgendes bemerken:

GIGLIO-TOS hat die drei nahe verwandten Familien der *Toxoderinae*, *Heterochaetae* und *Aethalochroae* weit auseinander gerissen und erstere durch

die ganz und garnicht hereingehörige Gattung *Stenophylla* verwässert, letztere beide durch das Dazwischenschieben der Gattung *Ceratocrania* aus dem Zusammenhang gebracht. Die drei oben genannten Gruppen bilden eine vollkommen natürliche, auf die alte Welt beschränkte Abteilung der *Vatinae,* die durch die breiten, abgeplatteten Cerci, gestreckte Gestalt, namentlich des Pronotums, die längsgekielten Mittel-und Hinterbeine (Femora und Tibien), das häufige Auftreten eines Stachels auf jedem Auge, sowie auch durch die in allen drei Gruppen vorkommende Zeichnung der Hinterflügel zusammengehalten werden. Man vergleiche z.B. die Abbildung von *Aethalochroa ashmoliana,* in: WESTWOOD, Revisio Mantid. 1889 Taf. 12 fig. 6 *(Aethalochroa)* mit der Abbildung von *Pareuthyphlebs occidentalis* (Mitt. Zool. Mus. Berlin, 14. Bd. 1. Heft Taf. II fig. 13) *(Paradanuriae)* und der hier beifolgenden der neuen Art *(Toxoderae)* und man wird über die vollständige Uebereinstimmung der Hinterflügelzeichnung in drei Familien überrascht sein. *Mesomicropus* verbindet durch den relativ kleinen Kopf die *Aethalochroae* mit den *Toxoderae,* durch das Fehlen der Erweiterung an der Basis der Vorderhüften die *Paradanuriae* mit den *Toxoderae.*

Die Unterfamilien der *Toxoderinae* sind vollkommen überflüssig und jedenfalls der Gruppe *„Heterochaetae"* nicht gleichwertig; dagegen können die *„Aethalochroae"* ohne weiteres in eine Reihe mit den *Paradanuriae* gestellt, d.h. als Unterfamilie eingezogen werden. Wahrscheinlich gehören auch die *„Austrovates"* noch in die Nähe, dagegen die *„Ceratocraniae"* aus der Nähe der *„Aethalochroae"* zu *Phyllothelys,* dann haben wir eine vollkommen einheitliche Gruppe altweltlicher Gattungen, die wir den eigentlichen neuweltlichen *Vatinae* gegenüberstellen können.

TOXODERINAE.

2. **Toxodera integrifolia** WERN.

WERNER, in: „Treubia" VI. 1925 p. 485, Taf. XXIV fig. 3.

♂ N. O. Sumatra, Deli, Tinggi Radja, 9. IX. 1928, J. C. VAN DER MEER MOHR.

♂ O. Java, Kediri, Teeunternehmung Penampean, 1000 m, VIII. 1921 (82 mm lang).

3. **Paratoxodera cornicollis** W. M.

♂ W. Java, Buitenzorg, 9. VIII. 1926, H. H. KARNY.

XV. HYMENOPODINAE.

1. **Odontomantis planiceps** (HAAN).

♂ ♀ W. Java, G. Papandajan, 1300 m, 2. VI. 1931, K. W. DAMMERMAN; ♂ G. Gedeh, Tjibodas, 1400 m, 1923, FULMEK.

♂ ♀ Centr. O. Borneo Exp., 30. IX., 8. X., 17. XI., und bei Long Petak, 450 m, 12. X. 1925, H. C. SIEBERS.

2. **Hestiasula phyllopus** (HAAN).
♂ ♂ Centr. O. Borneo, 16. X. 1925, H. C. SIEBERS.

3. **Catestiacula nitida** (BRUNNER).
♀ Centr. O. Borneo, 17. XI. 1925, H. C. SIEBERS.

Scutellum frontale mit vier vertikalen Wülsten, dazwischen tiefe Furchen. Ein dreieckiger Höcker am unteren Ende eines medianen Längswulstes oberhalb der Ocellen.

Vorderfemora innen oben nur mit zwei grossen gelben Flecken.

Länge 21 mm; Pronotum 3, Elytren 18, Vorderfemora 6 mm.

Das ♀ dürfte noch unbekannt gewesen sein.

5. **Hymenopus coronatus** (OL.).
♀ Larve, W. Sumatra, Loeboek Sikaping, 450 m, 1923-27, L. HUNDESHAGEN; ♂ ♀ Sumatra, LOERTZING.
♀ W. Java, Buitenzorg, und ♀ ♀ Larven, do., 11. V. 1922, 30. IV. 1924 CAMMERLOHER.
♀ S. O. Flores, Larantoeka, 10. XI. 1902, VAN DER SANDE.

Der letztgenannte Fundort dürfte wohl neu sein; leider ist das Belegexemplar in recht schlechtem Zustande.

6. **Creobroter granulicollis** (SAUSS.).
♀ ♀ Centr. O. Borneo, 5. X., 20. XI. 1925, H. C. SIEBERS.

7. **Creobroter urbanus** (F.).
♂ O. Java, Idjen Plateau, 950 m, VI. 1924, K. W. DAMMERMAN.

8. **Theopropus elegans** WESTW.
Larven, W. Sumatra, Loeboek Sikaping, 1923-27, L. HUNDESHAGEN.
♀ und Larven, W. Java, Bolang bei Buitenzorg, 600 m, 4. V. 1920, gesellschaftlich in Blütenstände von *Eupatorium canescens* am Wegrande, M. A. LIEFTINCK; ♀ ♀ Goenoeng Gedeh, Tjibodas, 12-1400 m, 4. X., und XII. 1927.
♂ ♀ Centr. O. Borneo Exp., 10. IX., und Kombari, XI. 1925, ENDERT & SIEBERS.

COCONS.

In der Sammlung befinden sich zwei Cocons, deren Zugehörigkeit mir ganz unbekannt ist. Ich möchte bei dieser Gelegenheit bemerken, dass auch aus dem indomalayischen Gebiete die Cocons nur der allerwenigsten Arten, anscheinend nur von *Hierodula* bekannt sind. Es wäre daher für solche Entomologen, die in der Lage sind, lebende trächtige ♀ ♀ von Mantiden zu finden, eine dankenswerte Aufgabe, solche in einem Raupenhaus bis zur Ablage des Cocons lebend zu halten und dann die Tiere abzutöten, und mit dem dazugehörigen Cocon dem Museum in Buitenzorg zur Bestimmung

einzusenden. Auf diese Weise käme man doch langsam wenigstens auf etwaige Unterschiede der Cocons in den verschiedenen Familien der Mantiden und es könnten diese Unterschiede nicht nur von systematischer sondern auch von phylogenetischer Bedeutung sein.

Cocon 1.

W. Java, Buitenzorg, 23. IX. 24. (v. SLOOTEN).
Länge und Höhe 4 mm, Breite 2 1/2 mm. Jederseits 4 deutliche Vertikalfurchen. Färbung silberglänzend, Oberfläche glatt.

Cocon 2 (Fig. 4).

W. Sumatra, 450 m, Loeboek Sikaping 1923 - 1927 (L. HUNDESHAGEN).
Langgestreckt, an beiden Enden zugespitzt, dorsal abgerundet mit dicken medianen Längswulst. Unterseite etwas concav (also jedenfalls an einer flachen Unterlage befestigt, während der vorerwähnte Cocon wahrscheinlich an einen Aestchen oder dergl. festgeklebt war). Jederseits etwa 15 quere Einkerbungen, dazwischen wulstige Erhöhungen, Hinter (?) ende glatt. Seitenränder der Ansatzfläche etwas gezähnelt.

Länge 40, Breite 9, Höhe 6.5 mm.

Fig. 1. — *Pnigomantis medioconstricta* (WESTW.), ♀ Larve. 2. — *Ephippiomantis ophirensis* WERN., ♂. 3. — *Mesomicropus anoplonotus*, n. sp., ♂.
4. — Cocon aus W. Sumatra.

ON SOME NEW SPECIES OF CARABIDAE, CHIEFLY FROM JAVA.

By

H. E. ANDREWES

(London).

The majority of the species described below come from the collection of the Buitenzorg Museum, the Director of which has kindly allowed me to retain the type specimens, but I have taken the opportunity of describing also a few new Javan species in my own collection. Two new genera are introduced here, both belonging to the *Licinini,* one from Java and one from the Sangi and Talaud group of islands.

Bembidion dammermani sp. n.
Length:- 5 mm.
Black, shiny: palpi (except penultimate joint), joints 1 and 2 of antennae, legs, and extreme apex of elytra ferruginous.
H e a d with parallel, rather uneven furrows, extending on to clypeus in front and diverging a little behind, eyes only moderately prominent, antennae hardly reaching basal fourth of elytra, surface practically impunctate, front lightly transversely striate. P r o t h o r a x convex, cordate, a fifth wider than head and as much wider than long, base truncate, a little wider than apex, sides rounded in front and sinuate a little before base, hind angles sharp, but slightly obtuse, with a very distinct carina; median line fairly deep, but only a little deeper behind than in front, front transverse impression obsolete, hind one and basal foveae deep, the latter wide and rounded, base moderately punctate, a large rounded pore on each side near middle of disk. E l y t r a subovate, rather flat, a third wider than prothorax, about three quarters longer than wide, border reaching a point opposite stria 5: striae fairly deep, the inner ones indistinctly, the outer ones quite clearly punctate and not very much shallower than the inner ones, 1 deep throughout, the rest evanescent close to apex, 8 joining the marginal channel at a fourth from base. Scutellary striole short, apical stria slight and irregular; intervals convex on disk, 3 with two pores adjoining stria 3. No microsculpture, except for some traces of isodiametric meshes on the head. Proepisterna moderately punctate, metasternal process unbordered.

W. J a v a: Mt. Pangrango, 2400 m. (DAMMERMAN) 1 ex. ♀

In many of its characters this species approaches the palaearctic subgenus *Synechostictus;* the nearest oriental ally seems to be *B. exaratum* ANDR. from North India, but *B. pendleburyi* ANDR. from Mount Kinabalu in Borneo is also a member of the same group. Neither of them is much like the Javan insect.

Bembidion salamander sp. n.

Length:- 3-4 mm.

Black, shiny, upper surface sometimes with a faint bluish tinge: Palpi (except penultimate joint), joints 1 and 2 of antennae, with basal half of 3 and 4, apical border of elytra, and legs flavous, femora sometimes infuscate at base, venter piceous.

H e a d with moderately deep, parallel furrows, diverging a little behind, eyes not very prominent, antennae reaching basal fourth of elytra, surface sometimes a little uneven, but practically impunctate. P r o t h o r a x convex, cordate, a fifth wider than head, and about as much wider than long, base truncate, slightly wider than apex, sides rounded in front, sinuate near base, hind angles sharply rectangular, with a clearly marked carina on each side adjoining them; median line fine, front transverse impression shallow, uneven, basal foveae small but deep, a little removed from the angles, base depressed, subrugose, with the barest traces of fine puncturation. E l y t r a oval, rather flat, two fifths wider than prothorax, four fifths longer than wide, border reaching a point opposite stria 5; striae finely punctate, moderately deep on disk, all shallower near base, but 1, 2, and the scutellary striole meet in a deep impression at base, outer striae shallower, 7 hardly impressed, 1 fairly deep behind, 2 shallower before but both deeper and wider close to apex, the rest evanescent near apex, except 8, which is deep behind and joins 9 at a third from base, scutellary striole short, apical stria deep; intervals moderately convex on disk, 3 with two well marked pores, each with a small tubercle in front of it. Microsculpture visible throughout, consisting of very wide meshes on the elytra, meshes about three times as wide as long on the prothorax, and isodiametric meshes on the head. Underside smooth and impunctate, metasternal process bordered.

W. J a v a: Mt. Gedeh Crater, 2600 m., and E. J a v a: Idjen, Ongop-Ongop, 1850 m. (all DAMMERMAN) 14 ex. Type from Gedeh Crater.

Very near *B. bryanti* ANDR. and possibly only a local form of that species. All the specimens, however, are both smaller and narrower, the sides of the prothorax are less strongly rounded, the shoulders of the elytra are more rounded, and there is a very faint bluish gloss. The microsculpture is similar.

Lissopogonus poecilus sp. n.
Length:- 4.5 mm.
Piceous, shiny, head and prothorax black, underside more or less brown; palpi, joints 1 to 4 of antennae, and legs ferruginous; apex of elytra and a very vague stripe on each, covering intervals 5-7, dull red.
H e a d moderately convex, with fairly deep frontal furrows, diverging behind, and bounded by a slight carina, neck lightly constricted, eyes small, antennae short, submoniliform, joints 1 and 3 equal, surface impunctate. P r o t h o r a x convex, cordate, two fifths wider than head, nearly a third wider than long, base a little produced at middle, its sides oblique, rather wider than apex, sides strongly rounded, hind angles projecting on each side as a small rectangular tooth, without carina; median line and front transverse impression rather slight, the basal sulcus rather deep, coarsely punctate, basal foveae small and, with the hind part of the marginal channel, moderately punctate. Elytra convex, oval, a third wider than prothorax, and hardly more than a third longer than wide; striae crenulate, just visible on disk, 1 deeper from middle to apex, 2 a little deeper near apex, outer striae obsolete, a small apical stria present (as in *Bembidion),* no scutellary striole; intervals flat, 3 with two minute dorsal pores at a fourth and behind middle, marginal series widely interrupted, surface smooth and impunctate. No microsculpture.
Smaller and wider than the Himalayan *L. glabellus* ANDR., the only other known species of the genus, also differently coloured. The eyes are more convex; the prothorax much wider and with strongly rounded sides, without carina in the hind angles, the base punctate; the elytra wider, stria 1 hardly impressed on the front half, two dorsal pores present.
E. J a v a: Tengger Mountains, 2000 feet (H. FRUHSTORFER), 1 ex. ♀ in my collection.

In *L. glabellus* the prothorax is only about a seventh (not „much" as in description) wider than long, there is a single dorsal pore at about middle, and, as in *poecilus,* there is no microsculptura.

Simous nubilus sp. n.
Length:- 13 - 13.5 mm.
Black, shiny; palpi, antennae, and tarsi piceous.
H e a d slightly convex, a little vague striation at sides, neck subconstricted, frontal impressions punctiform, eyes rather flat, antennae slender, extending a little beyond base of elytra. P r o t h o r a x moderately convex, four fifths wider than head, a third wider than long, strongly contracted in front, but only slightly behind, just before base, sides gently rounded, hind angles slightly obtuse but only a very little rounded, a pore and seta on the angle; median line extremely fine, basal foveae formed by a faint depression of the surface on each side, to which a slight linear impression is sometimes added, surface otherwise practically smooth. E l y t r a moderately convex,

ovate, basal border with only the suggestion of a tooth at shoulder, not quite a fourth wider than prothorax, three fifths longer than wide, widest just behind middle; striae moderately impressed, finely and indistinctly crenulate, rather deeper at sides, 1 and 2 arising in an umbilicate pore, 5, 6, and 7 not quite reaching base, scutellary striole formed mainly by minute punctures; intervals practically flat on disk, somewhat convex at sides, expecially behind shoulder, 3 with two minute pores, at about middle and at three fourths respectively. Microsculpture isodiametric throughout. Pro- and metasternal processes unbordered; metepisterna a little longer than wide; venter finely punctate at sides, apical segment ♂ with one seta, ♀ with two setae on each side.

Slightly smaller than *S. aeneus* LAF., and black instead of aeneous; the characters generally are very similar, but the elytral striae are rather shallower, and much less evidently crenulate.

E. Java: Pasoeroean, Boeloelawang, 1 ex. ♂ (type my collection) Boemiajoe, 1 ex. ♀ my collection); Idjen, Kendeng, 1400 m, 1 ex ♀ DAMMERMAN—Buitenzorg Museum).

Omestes gen. n.

Head wide; eyes separated, though not widely, from buccal fissure, with two supraorbital setae; clypeus deeply emarginate, exposing the basal membrane of the labrum, which is rather narrow, cleft nearly to its base, and sexsetose; mandibles short, stout, compressed and blunt at apex, right one deeply notched at middle, so that the basal portion projects upwards as a rounded knob; mentum with only a vestige of a tooth in the emargination, beneath which is a pair of setae; ligula rather narrow, bisetose at apex, paraglossae adnate, wider than ligula, extending far beyond it, gradually diminishing in width and bluntly pointed at apex; maxillary palpi long and slender, labial palpi shorter, the penultimate joint quadrisetose; antennae slender, the three basal joints glabrous. Prothorax subcordate, with two lateral setae on each side. Elytra rather flat, 9-striate and with a long scutellary striole, basal border entire, apex subtruncate, each side of the truncature slightly emarginate and with a short but sharp spine at each extremity. Underside glabrous. Legs moderately long; ♂ protarsi with 3 rather widely dilated joints.

The new genus belongs to the *Licinini,* but in two respects at least differs altogether from any other Eastern member of the group. The right mandible is somewhat similar in form to that seen in the Australian genus *Physolaesthus,* but the spines at the apex of the elytra, so common in some Eastern genera, e.g. *Catascopus* and *Colpodes,* are a very unusual feature.

Genotype *Omestes torta* sp. n.

Omestes torta sp. n.
Length:- 12 - 13 mm. Width:- 4.5 - 4.75 mm.
Black: palpi, antennae, and lateral margins of prothorax more or less rufous, basal half of the tarsal joints ferruginous.
Body winged. H e a d convex behind, depressed and with some vague striation in front, eyes large and hemispherical, genae visible, but very short. P r o t h o r a x moderately convex, a half wider than head and as much wider than long, about equally contracted at extremities, sides of base a little oblique, apex emarginate, front angles rounded, sides nearly evenly rounded, front seta well before middle, hind one on the border just before base, hind angles reflexed, evident though very obtuse; median line rather fine, transverse impressions very shallow, basal foveae wide but moderately deep, basal area and, to some extent, sides very finely and a little vaguely punctate. E l y t r a a third wider than prothorax, three fourths longer than wide, widest behind middle, though the sides are very nearly parallel, border forming a very obtuse angle at shoulder; striae fine, though clearly incised, very finely punctate, outer ones deeper close to base, which they do not quite reach, and also rather deeper near apex; intervals flat on disk, a little convex elsewhere, 3 with two pores, at a third and three fifths respectively, adjoining stria 2. Microsculpture of the elytra formed by meshes about twice as wide as long; on the prothorax the meshes are similar in shape but much finer; on the head the meshes are also very fine, and are isodiametric. Prosternal process unbordered; metasternal process finely bordered; metepisterna nearly twice as long as wide; ventral segments with three setae on each side, apical segment ♂ with one only.

S a n g i & T a l a u d A r c h.: Sangi Is., Mt. Doeata, Bahewa naar Lobo, 1926, 2 ex. ♂♂ (ERIE).

Genycerus gen. n.
H e a d small, eyes separated rather narrowly from the buccal fissure, with two supraorbital setae; clypeus somewhat depressed, bisetose, front margin slightly emarginate and asymmetrical, labrum deeply emarginate, asymmetrical, the left side in advance of the right; mandibles elongate, contracted to middle, then dilated to a fourth from apex, where there is a very sharp tooth on the inner margin, abruptly curved inwards at apex, which is sharp and pointed, a fairly deep emargination in each between the tooth and apex, the emargination setulose on the lower surface; mentum with a very broad, very short tooth in the emargination, truncate at apex, a transverse ridge forming its base; ligula wide at base, contracted towards and slightly asymmetrical at apex, apparently bisetose (but a row of small pores is visible along the front margin), paraglossae narrow, membranous, adnate, and extending a little beyond ligula; maxillae hooked and very sharp at apex, fringed nearly to apex with long bristles, the outer lobe two-jointed, spathulate; palpi pointed at apex,

maxillaries rather short and somewhat dilated, the apical a little longer than the penultimate joint, labials long and slender, the penultimate inwardly bisetose and quite as long as the apical joint, which is slightly setulose; antennae with the three basal joints glabrous, joint 3 compressed. Prothorax subquadrate, with two lateral setae on each side. Elytra 9-striate, scutellary striole vestigial, basal border entire. Underside glabrous. Legs moderately long; ♂ protarsi with 3 widely dilated joints.

This genus must be placed in the *Licinini,* but I know of no very near ally; the mandibles, which recall those of a *Lucanus* in miniature, will easily distinguish it from any other Licinid genus.

Genotype *Genycerus lucanoides* sp. n.

Genycerus lucanoides sp. n.

Length:- 6 mm. Width:- 2.6 mm.

Piceous beneath, upper surface black and iridescent: antennae, maxillary palpi, legs, and lateral margins of prothorax and elytra (narrowly) ferruginous; labial palpi, and apex of tibiae and of tarsal joints piceous.

Body apterous. Head convex, smooth, frontal foveae small and shallow, eyes rather large, front supraorbital pore very large, antennae slender, reaching basal fourth of elytra, joint 1 rather longer than 4, 3 a little shorter than 4, 2 less than a half of 1. Prothorax convex, three fourths wider than head (but see below), about a third wider than long, base with its sides oblique, evidently wider than apex, sides rounded and slightly reflexed, the front pore placed well before middle, the hind one on the angle, hind angles rounded but evident; median line fine, transverse impressions slight, basal foveae long, wide, and shallow, diverging in front and reaching middle, surface smooth, uneven along base. Elytra moderately convex, oval, a half wider than prothorax, a little more than two fifths longer than wide, border forming a very obtuse angle at shoulder, apex without sinuation; striae moderately impressed, vaguely crenulate; intervals only slightly convex, 3 with a single pore at basal third, adjoining stria 2, marginal channel wide and uneven, especially behind, with very large pores. Microsculpture of the elytra formed bij extremely fine lines; that of the prothorax formed by lines only a little less fine; on the head there are isodiametric meshes. Pro- and metasternal processes both bordered; metepisterna a little longer than wide; last ventral segment ♂ with a single seta on each side, ♀ with 5 small setae on each side, four along the margin and a fifth just in front of the inmost of them.

E. Java: Idjen, Kendeng III, 1400 m. (DAMMERMAN) 2 ex. ♂ ♀.

Some mischance has flattened the surface of the eyes, in both specimens, so that the relative proportions of the head and prothorax, as given above, will require some modification.

Coleolissus nitens sp. n.
Length:- 8.75 mm. Width:- 3.1 mm.
Black, upper surface very shiny but not iridescent; buccal organs, antennae, legs, border of prothorax (including a small area near hind angles), and border of elytra (including interval 9 near apex) more or less dark ferruginous. H e a d convex, impunctate, frontal furrows short, moderately deep, curving outwards behind, eyes only moderately prominent, antennae hardly extending beyond base of elytra, joint 3 twice as long as 2. P r o t h o r a x convex, quadrate, rather more than a half wider than head, a third wider than long, widest before middle, just behind the lateral pore, base evidently wider than apex, sides gently rounded, a little vaguely, though widely, explanate behind, hind angles rounded, but only slightly obtuse; median line and front transverse impression moderately deep, basal foveae wide, shallow, and uneven, a few vague punctures along base and in the marginal channels on each side towards base, surface otherwise impunctate. E l y t r a elongate-ovate, a fifth wider than prothorax, two thirds longer than wide, border deeply bi-emarginate, a fairly sharp angle at shoulder, margin slightly sinuate on each side near apex; striae deep, only the inner ones reaching base, striole short, arising with 2 in an umbilicate pore; intervals convex, 3 with three slight pores on apical half, adjoining stria 2, surface otherwise impunctate. Microsculpture of elytra and prothorax consisting of very fine transverse lines; hardly forming meshes; on the head some isodiametric meshes are just visible near the margins. Underside impunctate; prosternal process unbordered, metasternal process fidely bordered; metepisterna a little longer than wide. Pro- and mesotarsi ♂ with four slightly dilated joints, clothed beneath with scales along the sides, but naked in the middle; metatarsi with joint 1 as long as 2 + 3; joint 5 setulose beneath.

In size and form somewhat like the Indian species *C. andrewesi* ALLD. (= *iris* ANDR.), but rather narrower, without iridescence, the body almost impunctate.

W. J a v a: Mt. Gedeh, Tjibodas, 1400 m., 1 ex. ♂

Abacetus obscurus sp. n.
Length:- 4 - 4.5 mm.
Piceous beneath, upper surface black: palpi, joints 1 and 2 of antennae, and legs more or less ferruginous, femora sometimes infuscate, tibiae darker at extremities.
H e a d convex, smooth, eyes moderately prominent, sides in front of them bordered, frontal foveae moderately deep, curving inwards behind, antennae not extending far beyond base of elytra. P r o t h o r a x convex, cordate, fully a half wider than head, a fourth wider than long, base slightly arcuate, a little narrower than apex, sides bisetose, narrowly bordered, strongly rounded, and sinuate quite close to the hind angles, which project on each

side as a minute rectangular tooth; median line extremely fine, but a little deeper near base, transverse impressions faint, basal foveae linear, moderately deep, converging slightly in front, and joining the lateral channels close to the angles, base finely punctate between the foveae, otherwise smooth. Elytra convex, a fourth wider than prothorax, a little more than a half longer than wide, shoulders square, sides parallel; striae deep, impunctate, 2 arising in an umbilicate pore; intervals very convex, 3 with a pore at about middle, surface smooth. The microsculpture of the elytra is formed by meshes of very variable size, on average two or three times wider than long; on the prothorax the transverse striae are very fine and vague, hardly forming meshes; on the head the meshes are isodiametric. Underside smooth, prosternum longitudinally sulcate, both pro- and metasternal processes bordered; metepisterna a half longer than wide; metatarsi hardly sulcate, tarsal joint 5 without setae beneath.

Very much like *A. pallipes* CHAUD. and *A. femoralis* MOTCH., but a little larger, and all the parts a little wider; the sides of the prothorax are more strongly rounded, and the base has about a dozen punctures, instead of half a dozen, on each side of the median line; the striae on the elytra are equally deep, but the intervals are wider and a little flatter.

W. Java: Batavia, 1 ex; Prenang, 2 ex. (my collection).

Anchomenus oryctus sp. n.

Length:- 5.5 - 6 mm.

Piceous: palpi, antennae, margins of prothorax and elytra (including pro- and epipleura) and legs ferruginous.

Body apterous. Head flattened in front, frontal foveae wide and deep, with some slight longitudinal striation, vertex with a rather shallow curved excavation (convex backwards), eyes moderately prominent, genae evident, curving back sharply to neck, antennae reaching basal third of elytra. Prothorax cordate, slightly convex, two fifths wider than head, a fourth wider than long, sides bisetose, rounded and a little reflexed, somewhat explanate behind, gently sinuate before base, hind angles sharp though very slightly obtuse; median line and front transverse impression both moderately deep, basal foveae deep, elongate, diverging strongly outwards in front, a raised area on each side between them and the lateral channels, foveae rather lightly punctate, one or two small punctures on middle of base. Elytra flat, suboval, though with well marked shoulders, a half wider than prothorax, two fifths longer than wide, apex sharply, faintly, and widely sinuate on each side; striae rather fine, very vaguely crenulate; intervals nearly flat on disk, a little convex near apex, 3 with three fairly large pores; surface vaguely depressed behind base, and a little more evidently on intervals 5-8 near apex. Microsculpture of the elytra consisting of fine transverse lines, which form very wide meshes; on the prothorax the lines are fainter and the meshes less

wide; on the head the meshes are isodiametric and very faint. Metepisterna fully a half longer than wide. Apical ventral segment with a single seta on each side in the ♂, 2 in the ♀.

I have put this species into the genus *Anchomenus* with some hesitation. The metatibial spurs are unusually short, and I know of no other eastern species with a similar transverse impression on the vertex; the elytra are subtruncate at apex, but not more so than in some species of *Anchomenus*.

W. Java: Mt. Gedeh, Tjibodas, 1400 m (DAMMERMAN), 5 ex; E. Java: Idjen, Kendeng III, 1400 m. (DAMMERMAN), 3 ex.

Anchomenus lissus sp. n.

Length:- 4 - 5 mm.

Piceous, shiny: palpi, joints 1 to 4 of antennae, lateral margins of prothorax, border and suture of elytra, and legs more or less ferruginous.

Body apterous. Head smooth, convex, practically without neck constriction, clypeal suture and frontal foveae moderately deep, the latter bounded outwardly on each side bij a slight ridge, eyes not very prominent, genae short but evident, palpi small, antennae reaching basal fourth of elytra, pubescent from joint 4, which is as long as 3. Prothorax convex, a third wider than head and as much wider than long, base arcuate (convex backwards), slightly narrower than apex, sides strongly rounded and reflexed, more widely behind, without sinuation, a seta before middle and another in the hind angle, front angles rounded, hind angles distinct but very obtuse; median line very fine, transverse impressions and basal foveae fairly deep, the hind impression finely punctate, basal area depressed, finely and a little vaguely rugose-punctate. Elytra convex, ovate, two fifths wider than prothorax, not quite a half longer than wide, border rounded at shoulder, only a trace of sinuation behind; striae finely punctate, 1 ligthly impressed in front, deeper behind, 2 and 3 very faintly impressed, 4 and 5 just traceable by the punctures, 6 and 7 obsolete, 8 moderately deep, scutellary striole visible, a short apical stria present (continuing 5 or 7); intervals flat, 3 with two small pores on the interval, at a fourth and three fifths. Microsculpture on the elytra formed by meshes about twice as wide as long, none on head and prothorax. Underside impunctate; metepisterna a little longer than wide; last ventral segment ♂ with one marginal seta, ♀ with three setae on each side. Joint 1 of metatarsi vaguely outwardly sulcate; joint 5 with one or two slight setae beneath.

About the same size as the Himalayan *A. lissopterus* CHAUD., but not so dark and with more evidence of striation on the elytra, the eyes less flat, the prothorax with more strongly rounded sides, the base depressed and rugose-punctate, the elytra with at least stria 1 moderately impressed.

W. Java: Mt. Pangrango, 3000 m. (DAMMERMAN), 14 ex.; Mt. Gedeh, 3000 m. (T. v. B. JUTTING), 2 ex; Tjibodas, 1 ex.

Dicranoncus vulpinus sp. n.

Length:- 8 mm.

Piceous: underside (including epipleura), and underside of femora pale chestnut brown; prothorax, marginal channel of elytra, palpi, antennae (except joints 2 and 3), and tibiae ferruginous; joints 2 and 3 of antennae, and tarsi pale ferruginous.

Head small, convex, frontal foveae short, but fairly deep, an uneven rounded impression on each side opposite middle of eye, eyes flat, genae continuing their outline and as long as eyes, antennae slender, reaching basal third of elytra. Prothorax moderately convex, a half wider than head, an eighth wider than long, base a little wider than apex, both slightly emarginate, all the angles rounded, the hind more than the front ones, sides evenly rounded, narrowly reflexed in front, more widely behind, without lateral setae; median line very fine, transverse impressions slight, basal foveae large, rounded, and fairly deep, base and marginal channels finely and hardly perceptibly punctate. Elytra moderately convex, elongate-oval, about three fifths wider than prothorax, nearly three fourths longer than wide, border obtusely angulate at shoulder, slightly emarginate on each side behind, apex truncate over a width of three intervals on each side, each part of the truncature with an obtuse external angle and a very sharp inner tooth, almost a spine, the epipleura with a longitudinal row of dark punctures down the middle; striae fine but moderately impressed, finely and vaguely crenulate, deeper near apex; intervals only slightly convex, 3 wih three inconspicuous pores, surface impunctate, a faint elongate depression at apical fourth on intervals 5 - 6, and another close to apex on interval 5. Microsculpture of the elytra formed by very wide, slightly oblique, though nearly transverse meshes; none on head or prothorax. Last ventral segment ♀ with two setae on each side. Metatarsi bisulcate; fourth tarsal joint deeply emarginate; fifth joint setulose beneath.

Not unlike *D. cinctipennis* CHAUD., from Ceylon, but a little longer and narrower and differing in colour. The eyes are flatter, the genae longer and more evident, the prothorax narrower, elytra with the shoulders quite rounded away, the border forming a much less obtuse angle at shoulder, the striae more impressed and much deeper near apex.

West Java: Soekaboemi, 2000 feet (H. FRUHSTORFER), 1 ex. ♀ in my collection.

Euplynes viridis sp. n.

Length:- 7 - 7.5 mm.

Ferruginous, shiny; elytra metallic green.

Head smooth, rather flat, frontal foveae very short, eyes large, hemispherical, antennae reaching basal fourth of elytra. Prothorax subcordate, rather flat, about a fourth wider than head, a half wider than long, base much

wider than apex, its sides oblique, front angles rounded, sides bisetose, rounded, sides bisetose, rounded in front and faintly sinuate behind, hind angles sharp, but a little obtuse, slightly reflexed; transverse impressions very shallow, median line and basal foveae moderately deep, the latter finely punctate. E l y t r a flat, two thirds wider than prothorax, rather less than a half longer than wide, shoulders evident, sides nearly parallel, apex subtruncate, slightly emarginate on each side; striae moderately deep, with traces of fine crenulation, intervals lightly convex, 3 with three pores, 5 with a deep elongate depression on basal half, one fourth as long as the elytra, and rather darker in colour, stria 3 a little deeper and striae 5 and 6 pushed a little outwards opposite the depression, surface impunctate, but uneven. Microsculpture of the elytra consisting of fine transverse lines forming very wide meshes; on the prothorax the meshes are less wide, but very faint, and on the head they are wanting.

Very similar in form to *E. aurocinctus* BATES, but quite differently coloured; the head and prothorax hardly differ, but the elytra are less deeply striate, particularly towards apex, the depression on interval 5 slightly longer, the surface generally rather less uneven.

W. J a v a: Tjibodas, 1400 m (H. H. KARNY), 3 ex.

Galerita toreuta sp. n.
Length:- 18 - 19 mm. Width:- 6.5 - 7 mm.
Black, dull, tarsi piceous.
Body apterous, shortly pubescent. H e a d with moderately deep, uneven, frontal foveae, separated by a smooth rounded longitudinal ridge, eyes moderately prominent, genae conspicuous, setose, a little longer than eyes, antennae reaching middle of elytra, joint 1 = 2 + 3, basal half moderately and not very closely punctate. P r o t h o r a x cordate, slightly convex, just wider than head, a sixth longer than wide, sides gently rounded in front, and equally gently sinuate behind, hind angles right, reflexed, a little rounded; median line and basal foveae moderately deep, surface closely and confluently punctate at sides and base, rather more sparsely on disk. E l y t r a ovate, depressed, nearly twice as wide as prothorax, two thirds longer than wide, strongly contracted at base, the shoulders rounded away, truncate at apex; the 8 inner costae are well marked and almost carinate, but 9 is slight and does not nearly reach the extremities, secondary costae very fine, each of the three narrow intervals between two primaries vaguely punctate. The surface of the elytra is covered with minute elongate granules, arranged in transverse lines, and there are also here and there a few aciculations; on the prothorax there is a microsculpture formed by meshes two to three times wider than long; on the head the meshes are isodiametric.

Smaller than *G. feae* BATES, but similar in colour; the head and prothorax are not dissimilar, but the elytra are much more dilated behind, the

costae are more raised, and the surface is more strongly, though more sparsely, aciculate.

E. Java: Idjen Plateau: Kendeng Mountains, 4 ex.

Brachinus stygius sp. n.

Length:- 13.5 - 14.5 mm. Width:- 5.6 - 6.4 mm.

Black: underside, palpi, antennae, and epipleura more or less piceous.

Body wieged, finely pubescent. Head convex, with the frontal foveae wide, shallow, and longitudinally striate opposite the eyes, neck subconstricted and punctate, surface uneven, with isodiametric microsculpture, a little rugose on middle of vertex, eyes rather prominent, genae setose, antennae stout, extending beyond middle of elytra, mentum with a large deep rounded fovea on each side. Prothorax cordate, slightly narrower than head and slightly wider than long, base hardly wider than apex, sides rounded in front and strongly sinuate at a fourth from base, hind angles projecting laterally, slightly acute, though not sharp; median line fine, deeper towards base, basal foveae moderately deep, surface densely covered with isodiametric asperities, the disk transversely rugose, the base with some longitudinal striation, sides vaguely punctate. Elytra moderately convex, nearly two and a half times wider than prothorax, fully a half longer than wide, shoulders quite evident though rounded, dilated behind and widest at apical third, apex truncate, each side of the truncature slightly emarginate, the membranous border glabrous; no striae visible, intervals faintly costate, surface densely covered with minute elongate asperities. Underside with a pale pubescence rather longer than that of the upper surface; metepisterna very long and narrow.

About the same size as *B. bigutticeps* CHAUD., but the femora are piceous, and there are no pale spots on the head; the prothorax and elytra are both narrower, while on the latter there are no visible striae, and the costae are very slight.

E. Java: Idjen Plateau, 5 ex.

Scopodes irregularis sp. n.

Length:- 3.5 - 4 mm.

Greenish bronze, elytra very dark, dull bronze, somewhat tessellated; base of palpi, joints 1-2 of antennae, with basal half of 3-4 (rest fuscous), and legs ferruginous.

Head a third wider than prothorax, with immense, prominent eyes, clypeal suture deeply impressed, surface densely longitudinally striate, neck vermiculate, separated from head by a fairly deep furrow, antennae submoniliform, slightly dilated at apex, barely reaching beyond base of prothorax. Prothorax rather flat, strongly produced in the middle at both extremities, which are arcuate, front angles rounded and inconspicuous, about a fourth wider than long, widest at a fourth from apex, at which point there

is on each side a tooth and seta, a little contracted behind, the hind angles, at about a fourth from the apparent base, also with a tooth and seta; median line clearly indicated in front only, surface densely vermiculate. Elytra moderately convex, fully two thirds wider than prothorax, not quite a half longer than wide, a little dilated behind and widest at apical third, shoulders rounded, apex obliquely truncate, the truncature on each side bordered and slightly emarginate, the apex of each elytron separately pointed; striae lightly impressed, impunctate, intervals moderately convex, 3 very large dorsal foveae on each side, each occupying the greater part of the first five intervals, surface very irregularly sculptured, with a dense microsculpture, formed by meshes of all sizes and shapes.

E. Java: Idjen, Ongop - Ongop, 1850 m. (DAMMERMAN), 4 ex.

This is the first species of the genus to be discovered outside the limits of Australasia. It seems to be most nearly related to *sigillatus* GERM., but is larger, the elytra duller and much more irregularly sculptured.

Dolichoctis pumila sp. n.

Length:- 3.6 mm.

Piceous, margin of elytra and legs ferruginous, apex of palpi, antennae, and a small oblong apical spot on each elytron pale ferruginous, the spot placed on interval 4 and surrounded by a dull red area.

Head convex, smooth, with a small pore on vertex, frontal foveae small, eyes not very prominent, antennae slight, submoniliform, hardly extending beyond base of prothorax. Prothorax convex, barely a third wider than head, exactly a third wider than long, base arcuate, its sides oblique, slightly wider than apex, sides reflexed, formed by two practically straight lines, which meet in an obtuse angle a little before middle, hind angles obtuse but hardly rounded, a seta on the lateral and another on the hind angle; median line and front transverse impression both moderately deep, base depressed, basal foveae small but deep, continued outwards in front so as to isolate a slight raised area wihin each hind angle, surface otherwise smooth. Elytra convex, subquadrate, four fifths wider than prothorax, a third longer than wide, slightly dilated behind and subtruncate at apex; striae moderately impressed and vaguely crenulate, deeper at sides, scutellary striole slight; intervals a little convex on disk, much more convex and narrower at sides, 3 with three minute pores, at middle, and close to base and apex respectively. There is no evident microsculpture on either prothorax or elytra; the head is covered by isodiametric meshes.

About the size and shape of *D. angulicollis* CHAUD., but the elytra have a small apical spot instead of two fasciae; the lateral angles of the prothorax are less pronounced, and the raised area on each side within the hind angle

is very slight instead of conspicuously convex; on the elytra the dorsal pores, evident in *angulicollis,* are barely visible.

W. Java: Palaboean Bay (H. FRUHSTORFER), 1 ex. in my collection.

Parena testacea CHAUD., Mon. des Callidides, Ann. Soc. Ent. Belg. XV. 1872, p. 178.

Var. **cruralis** var. nov.

The specimen which I have before me differs in two particulars from the type form, viz. (i) the tibiae are black, as well as the tarsi, (ii) the depression on the middle of each elytron, a somewhat important character in this genus, is altogether wanting. The length is 10 mm.

W. Java: Pengalengan, 4000 feet (H. FRUHSTORFER), 1 ex. in my collection.

SOME NEW OR RARE FISHES OF THE INDO-AUSTRALIAN ARCHIPELAGO. III [1]

By

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Fam. CARANGIDAE.

CARANX Lacépède.

Caranx (Carangoides) auroguttatus C.V.

D.[1] VIII, D.[2] 25, A. II - I 23, P. II 19, V. 5.

Body elongated and compressed. Dorsal profile convex, ventral profile much less so. Height 3.0 - 3.2 in length [2]). Head somewhat pointed, profiles of forehead and lower jaw meeting in an angle of about 75°. Head 3.8 - 4.2 in length. Eye 4.7 in head. Maxillary reaches to just before or just below eye. Teeth equal, very small, in villiform bands, which are not confluent at the isthmus of lower and upper jaw; small teeth on vomer, palatines and tongue. Breast almost totally scaly, only anteriorly in the middle line a small but conspicuous spot. Anterior part of lateral line shallowly arched. Straight posterior part commencing below 12th ray of soft dorsal. The 20 - 22 hindermost scutes pointed. Those on the caudal peduncle strong and elevated, forming a keel, ± 110 - 125 scales in lateral line. Third dorsal spine the longest, 3 - 3.5 in height of body. First part of soft dorsal and of anal elevated, somewhat falcate. Longest, soft, dorsal ray 2.5 - 2.7 in greatest height of body. Pectorals slender, falcate, reaching byond elevated part of anal. Ventrals 2.7 in head, surpassing anus, lying in a flattened part of the abdomen. This aplated part is naked. The innermost ventral ray is connected with the abdominal skin by a soft membrane. Colour grayish green above, yellowish silvery below. Upper and lower jaw yellowish. Ventrals, caudal, dorsal and anal yellow. Pectorals yellowish hyaline. Body with numerous small golden spots, a few on head.

This species, which according to literature, should be very rare in the Indo-Australian Archipelago, is regularly to be seen in the fishmarket of Batavia in small numbers since some time ago. It is caught by Japanese fishermen,

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[1]) Cfr.: Treubia, XIII, p. 411; XIV, p. 215.

[2]) By length is always meant the length of head and body without caudal fin, unless stated otherwise.

who take the shoals of Caesio on the submerged coralreefs in the Java-sea. The description given above is made after a few specimens of about 40 cm.

Literature:

1. *Caranx fulvoguttatus* RÜPPEL. Atl. Fishe Nördl. Afrika 1828, p. 100.
2. *Carangoides auroguttatus* BLEEKER, Nat. Tijdschr. Ned. Ind. IV, 1853, p. 470. — o.c. VI, 1854, p. 175 — Versl. Akad. Amsterdam XII, 1861, p. 53.
3. *Caranx fulvoguttatus* GÜNTHER, Cat. Brit. Mus. II, 1860, p. 439.
4. *Caranx (Carangoides) auroguttatus* KLUNZINGER, Fishe Roth. Meer. 1884, p. 98.
5. *Caranx (Carangoides) auroguttatus* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago Vol. VI, 1931, p. 225.

Caranx (Carangoides) fulvoguttatus (FORSK.).

D.[1] VIII, D.[2] I 28, A. II - I 25, P. I 19, V. I 5.

Body elongate. Dorsal profile rounded, ventral profile almost straight from chin to anal. Height 2.3 - 2.5 in length. Head 3 - 3.3 in length, obtuse, rostrofrontal profile convex. Eye 4.3 in head, situated in its middle, 1.6 in snout. Maxillary reaches to just below eye. Chin sometimes somewhat prominent. Height of praeorbital about equal to eye. Teeth in jaws in villiform bands, not united in the symphyses. Small teeth present on vomer, palatines and tongue. A conspicuous naked area in front of ventrals, reaching upwards to about middle of distance between ventral line and base of pectorals. Anterior part of lateral line shallowly arched, straight part beginning below 14th or 15th soft dorsal ray, 14 - 17 keeled scutes, the first one below or behind last dorsal ray. Only the hindermost scutes feebly armed. Third dorsal spine longest, 3.3 in height of body. Anterior soft rays of dorsal elevated, falcate, twice in greatest height of body. Anterior rays of anal elevated, falcate, about as high as longest dorsal rays. Anal and dorsal with a high scaly sheath especially in the anterior half. Pectorals long slender, falcate, reaching to second half of anal. Ventrals about 2.5 in head, innermost ray connected with abdominal skin by a membrane. Greyish-green above, silvery below. A blackish spot on operculum. Brownish spots on body.

Of late found regularly in small numbers in the fishmarket of Batavia. They are caught under the same circumstances as *Caranx auroguttatus*.

Literature:

1. *Scomber fulvoguttatus* FORSKAL. Descr. Animal. 1775, p. 56.
2. *Carangoides fulvoguttatus* BLEEKER, Nat. Tijdschr. Ned. Indië, II, 1851, p. 178 — Makreel. Visch. Verh. Batav. Gen. XXIV, 1852, p. 89.
3. *Caranx (Carangoides) fulvoguttatus* KLUNZINGER. Fische Roth. Meer. 1884, p. 98.
4. *Caranx bleekeri* BAMBER, Journ. Linn. Soc. Zoöl. XXXI, 1915, p. 480.
5. *Caranx (Carangoides) fulvoguttatus* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago Vol. VI, 1931, p. 228.

Caranx (Caranx) stellatus EYDOUX and SOULEYET.

D.[1] VIII, D.[2] I 22, A. II - I 19, P. I 20, V. I 5.

Body rather elongate. Dorsal profile straight from soft dorsal fin to nape, from there strongly declivous to snout, from soft dorsal strongly descending to caudal peduncle. Ventral profile approximately straight from anal to chin, strongly ascending from anal to caudal peduncle. Height 2.6 in length. Head 3.1, about as high as long. Eye 5.4 in head, 2.0 in snout. Posterior adipose eyelid well developed. Mouth oblique, chin somewhat prominent. Maxillary reaches to below middle of eye. Teeth in upper jaw in a villiform band, with an outer row of canines. In lower jaw only one single row of canines present. Small teeth present on vomer, palatines and tongue. 14 - 15 short aplated gillrakers on lower branch of first gillarch. Lateral line arched to below 4th or 5th soft dorsal ray. Posterior part straight, with 35 - 36 armed scutes. Body totally covered with rather large scales, only those in front of ventrals smaller, on the head present behind eye and on cheeks. Operculum, forehead and nape naked. Third dorsal spine longest, 3.2 in head.

First rays of soft dorsal and of anal forming a strongly elevated lobe. Longest ray of dorsal about 1.7 in height. Longest anal ray about 2 in height. Both fins with a small scaly sheath. Pectorals slender, falcate, reaching to 8th soft ray of anal. Ventrals surpassing anus, about 5.5 in height. Caudal widely forked with equal lobes. Body greenish above, becoming silvery in the lower parts. Soft dorsal, anal and caudal blackish. Spinous dorsal, ventrals and upper rays of pectorals dusky. Pectorals with a median yellow stripe. On head and body scattered small black spots.

Sometimes a few specimens at the fishmarket of Batavia in the same catches as *Caranx auroguttatus* and *fulvoguttatus*. The description is made after a specimen with a total length of 42 cm.

Literature:

1. *Caranx caeruleopinnatus* CUVIER and VALENCIENNES. Hist. Nat. Poiss. IX, 1933, p. 119.
2. *Caranx punctatus* BLEEKER, Verh. Batav. Gen. XXV, 1853, p. 44.
3. *Caranx melampygus* GÜNTHER, Fische Südsee II. Journ. Mus. Goddeffroy, 1876, p. 133 (p.p.).
4. *Carangus Quoyi* BLEEKER, Arch. néerl. Sc. nat. XIII, 1878, p. 50.
5. *Caranx melampygus* DAY, Fish. India 4°, 1876 - 1888, p. 214 (p.p.).
6. *Caranx caeruleopinnatus* SAUVAGE, Hist. Nat. Poissons Madagascar, Paris 1891, p. 331 (nec. RÜPPELL).
7. *Carangus melampygus* JORDAN and EVERMANN, Bull. U.S. Fish. Comm. XXIII, (1903) 1905, p. 192 (nec. C.V.).
8. *Caranx melampygus* JORDAN and SEALE, Bull. Bur. Fish. XXV, (1905) 1906, p. 230.
9. *Caranx stellatus* MC. CULLOCH, Rec. Austral. Mus. XV, 1926, p. 33.

10. *Xurel stellatus* JORDAN, EVERMANN and CLARK, List Fish. North and Middle America, Washington 1930, p. 273.
11. *Caranx* (*Caranx*) *stellatus* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VI, 1931, p. 253.

Caranx (Selar) djeddaba (FORSK.).

D.[1] VII, D.[2] I 24, A. II - I 21, P. I 23, V. I 5.

Rather oblong, dorsal and ventral profiles evenly and equally convex. Height 2.9, head 3.8 in length. Eye 4.0 in head, about equal to snout. Posterior adipose eyelid well developed, covering hindpart of pupil. Jaws subequal. Maxillary reaching to below frontborder of eye. Uniserial fine teeth on jaws. Small patches present on vomer, palatines and tongue. Body entirely covered with rather small scales, only a small spot on median line of breast just behind gillopening naked. The head is naked with the exception of small patches behind eyes and on cheeks. Lateral line strongly curved in anterior part, which goes about twice in straight posterior part, which bears 57 scutes. Dorsal spines moderate, the third slightly the largest, 2.7 in height of body. Anterior rays of soft dorsal and of anal only slightly elevated. Pectorals falciform, reaching to first rays of anal. Ventrals surpassing anus, about 3 in height of body. Caudal deeply forked, the lobes subequal and pointed. 27 gillrakers on lower part of first gillarch. Colour bluish-greenish above, silvery below. Spinous dorsal blackish. Soft dorsal black-edged. Anal grayish with a white border. Caudal blackish, especially the tips of the lobes. Ventrals and pectorals hyaline. Faint blackish spot on operculum.

Sometimes present in small numbers mingled with *Caranx auroguttatus*, *fulvoguttatus* and *stellatus* in the catches of the Japanese fishermen. The specimen, described above, was caught in the Java-Sea and had a total length of 35 cm.

Literature:

1. *Scomber djedaba* FORSKAL, Descr. animal. 1775, p. 56.
2. *Selar vari* BLEEKER, Verh. Bat. Gen. XXV, 1853, p. 44 (name only).
3. *Caranx djeddaba* GÜNTHER, Cat. Brit. Mus. II, 1860, p. 432.
4. *Selar djeddaba* BLEEKER, Versl. Akad. Amsterdam XII, 1861, p. 75 (name only).
5. *Caranx Djeddaba* DAY, Fish. India 4°, 1878 - 1888, p. 218.
6. *Caranx* (*Selar*) *djeddaba* KLUNZINGER, Fishe Roth. Meer. 1884, p. 97.
7. *Caranx djeddaba* EVERMANN and SEALE, Bull. Bur. Fisheries XXVI, (1906) 1907, p. 65.
8. *Caranx djeddaba* JORDAN and RICHARDSON, Bull. Bur. Fish. XXVII, (1907) 1908, p. 250.
9. *Caranx djeddaba* HORA, Mem. Asiat. Soc. Bengal VI. 1924, p. 485.
10. *Caranx djeddaba* BARNARD, Ann. S. Afric. Mus. XXI, 1925 - 27, p. 456.
11. *Caranx* (*Selar*) *djeddaba* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VI, 1931, p. 214.

ULUA JORDAN and SNYDER.

Ulua mandibularis (MACLEAY).

D.[1] VIII, D.[2] I 21, A. II - I 17, P. I 19, V. I 5.

Body high and compressed. Dorsal profile more rounded than abdominal one, strongly convex from snout to soft dorsal. Height 2.2 in length, head 3.1. Adipose eyelid forming a narrow rim round the eye. Maxillary extends to below pupil. Chin prominent. Gape of mouth commences below lower border of eye. Teeth minute in a single series on jaws, in small patches on vomer and palatines, none on tongue. Gillrakers long, feathershaped, about 55 on lower branch of first gillarch, top of operculum and a part of temporal region scaly. Scales on body small, wanting before a line drawn from base of pectorals to a spot somewhat behind base of ventrals. Anterior part of lateral line shallowly arched, the curved part somewhat shorter than straight part, which bears about 30 feeble scutes. Dorsal spines weak the third one the highest and the first bent forwards. Anterior rays of dorsal and anal much prolonged and forming a falcate lobe. First soft dorsal ray much longer than head, about as long as pectorals. A high scaly sheath present on base of dorsal and anal. Caudal deeply forked, the lobes equal. Pectorals slender, falcate, 2.4 in length. Ventrals short, surpassing anus, 3.8 in height of body. Colour greenish above, silvery below. Margin of caudal and dorsal blackish. Anal almost hyaline. Chin and axis of pectoral black.

This description is made after a specimen with a total length of 21 cm. Fishmarket of Batavia 11-5-'33.

Literature:

1. *Caranx mandibularis* MACLEAY, Proc. Linn. Soc. N.S. Wales VIII, 1883, p. 356.
2. *Caranx mandibularis,* JORDAN and SEALE, Bur. Fish. XXV, 1905, p. 234.
3. *Carangoides mandibularis,* FOWLER, Fishes of Oceania, Bishop Museum X, 1928, p. 151.
4. *Ulua mandibularis,* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago VI, 1931, p. 266.

CHORINEMUS C.V.

Chorinemus sancti petri C.V.

D.[1] VII, D.[2] I 21, A. II - I 18, P. I 16, V. I 5.

Body slender, lanceolate and compressed. Head about equal to height of body. Height 4.4 in length. Head rather pointed, a slight depression above eyes. Eyes about 4 in head, about as long as snout. Chin somewhat prominent. Maxillary rather narrow, reaching to hindborder of pupil. Teeth in upper jaw anteriorly in a villiform band, posteriorly in one row. Teeth in lower jaw

anteriorly in a villiform band, posteriorly in two rows. Teeth in both jaws of equal length, no canines. Teeth in villiform bands on vomer, palatines pterygoids and tongue. Scales small, entirely covered by skin, not present on head. Only on the caudal peduncle the scales are more or less free. Lateral line angular to below third dorsal spine, thence about straight. Dorsal spines flattened, shorter than eye, the anterior ones just overlapping each other, the posterior ones not covering each other. Anterior rays of soft dorsal and anal somewhat elevated, the longest rays 2.6 in head. 13 finlets in dorsal and anal. Pectorals small triangular, with rounded angles. Ventrals not reaching anus, lying in an abdominal groove. Ventrals shorter than pectorals. Colour blueish above, silvery below. A row of four obvious, elongated, black blotches on sides. The two first blotches are cut by the lateral line, the third reaches with its lower border on to lateral line, the fourth quite above it. Before and behind this row of four are traces of other blotches. A black spot above base of pectoral. It is continued on upper part of operculum. Chin blackish. Anterior part of soft dorsal with a black blotch. Anal hyaline. Caudal dusky.

Now and then mingled with the above-named *Caranx*-species in the catches of the Japanese fishermen.

The description is made after a specimen with a total length of 32.5 cm.

Literature:

1. *Chorinemus sancti petri,* CUVIER and VALENCIENNES, Hist. Nat. poss. VIII, 1831, p. 379.
2. *Chorinemus sanctri petri,* GÜNTHER, Cat. Brit. Mus. II, 1860, p. 473 (nec. synon.).
3. *Chorinemus Sancti Petri* KLUNZINGER? Fishe Roth. Meer. 1884, p. 106.
4. *Chorinemus sancti petri,* SAUVAGE, Poiss. Madagascar. 1891, p. 331.
5. *Chorinemus sancti petri* STEINDACHNER, Denkschr. Akad. Wien LXX, 1900, p. 496.
6. *Scomberoides sancti petri* JORDAN and EVERMANN, Bull. U.S. Fish Comm. XXIII, (1903) 1905, p. 181.
7. *Scomberoides sancti petri* WAKIYA, Ann. Carnegie Mus. XV, 1924, p. 213.
8. *Chorinemus sancti petri* WEBER and DE BEAUFORT, Fishes of the Indo Australian Archipelago VI, 1931, p. 280.

Fam. **SCOMBRIDAE.**

ACANTHOCYBIUM JENKINS.

Acanthocybium solandri (C.V.).

D. XXVII - I 6 + X, A. II - 11 + VIII.

Body elongated, fusiform. Head very long, slender, 6.6 in total length. Mandible somewhat longer than upper jaw. About 50 triangular, slightly serrated teeth in each jaw. Jaws forming a kind of beak. Cleft of mouth extending to below eye. Posterior part of the maxillary covered by the praeorbital bone. Maxillary somewhat longer than snout. Villiform teeth on vomer and palatines.

Gill-laminae forming a network. Gillrakers totally absent. Snout about 1.3 in head. Eye about 6 in snout. Height about 7 in total length. Linea lateralis arched in anterior part becoming straight below 17th dorsal spine. Scales very small. Pectorals reaching to below 10th dorsal spine. Dark-grey with faint traces of vertical bands.

One specimen of 150 cm in the fishmarket of Batavia 18-8-'33.

Called by the natives Tengiri salassi or Tengiri bahar (Tengiri is the common name for *Scomberomorus*-species).

Literature:

1. *Cybium solandri* CUVIER and VALENCIENNES, Hist. Nat. Poiss. VIII, 1831, p. 192.
2. *Cybium solandri* GÜNTHER, Fische der Südsee. 1876, p. 153.
3. *Acanthocybium solandri* JENKINS, U.S. Fish. Comm. Bull. Vol. 22, 1902, p. 441.
4. *Acanthocybium solandri* SNYDER, U.S. Fish. Comm. Bull. Vol. 22, 1902, p. 523.
5. *Acanthocybium solandri* JORDAN and EVERMANN, U.S. Fish. Comm. 1903, p. 176.
6. *Acanthocybium solandri* FOWLER, Fishes of Oceania, 1928, p. 135.

Fam. **POLYNEMIDAE.**

POLYNEMUS L.

Polynemus pfeifferi BLKR.

D.[1] VIII, D.[2] I 12, A. III 11, P. I 14 + 6, V. I 5, L.l. 50, L.tr. 6.1.10.

Height 3.1, head 3.1 in length. Eye 3.3 in head, about twice in postorbital part of head. Snout short, about ¾ of eye. Mouth large, reaching behind eye. Maxillary twice in head. Teeth in jaws in a narrow villiform band. A rounded patch of teeth on vomer and two oblong patches on palatines. Head covered with scales to end of snout. Anterior and posterior nostrils close together, close to frontborder of eye. Hindborder of praeoperculum serrated. The lowest denticulation much stronger than the rest. Angle of praeoperculum produced and rounded. Upper lip absent, lower lip well developed but not continuous at symphysis. First dorsal spine minute, third one the longest, somewhat longer than postorbital part of head. Third spine of anal somewhat longer than eye. Origin of anal below second ray of dorsal. Free border of dorsals and anal almost straight. Anal and dorsals covered by a sheath of scales. Caudal deeply forked, upper lobe a little longer than lower. Pectorals as long as head without snout. Longest pectoral filaments well reaching anal. Ventrals somewhat longer than postorbital part of head. Distance from origin of ventrals to origin of anal about as long as soft dorsal. Scales with a spinulated hindborder. Colour brownish-silverish. Pectorals and ventrals blackish. Dorsals and caudal more or less dusky.

The description is made after a specimen of 13 cm acquired by Prof. H. C. DELSMAN, Wijnkoopsbay (South-coast of Java), Juni 1933.

Literature:

1. *Polynemus pfeifferi* BLEEKER, Nat. Tijdschr. Ned. Indië IV, 1853 p. 249.
2. *Polydactylus pfeifferi* FOWLER, Proc. Acad. Nat. Sci. Philad. 1900, p. 501.
3. *Polynemus pfeifferi* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago IV. 1922, p. 208.

Fam. SOLEIDAE.

DEXILLUS CHABANAUD.

Dexillus macrolepis (BLKR.).

D. 61, C. 16, A. 46, P. dextr. vestigial, P. sin. 5, V. 3, L.l. 67, L. v. 17-1-19.

Height about 2.5, head 4.0 in length. Eyes small contiguous, the upper a little in advance of the lower, about 10 in head. Mouth curved, extending to below anterior border of eyes. Head and body covered with hairlike papillae on coloured side becoming scarcer towards the tail. On the blind side these papillae are only present on head and forepart of body. Both nostrils on coloured side close together before eyes, tubular. Dorsal begins on snout. Rays of vertical fins divided, covered with scales. Dorsal, caudal and anal, completely united. Scales strongly ctenoid on both sides. One straight lateral line on blind and on coloured side. Uniform brown.

A few individuals from the mouth of the Kumai-river, South-West Borneo, 10-5-'31. The description is made after a specimen with a total length of 15 cm. Mr. J. R. NORMAN, Assistent-Curator of the British Museum was so kind as to identify this species for me.

Literature:

1. *Synaptura macrolepis* BLEEKER, Act. Soc. Scient. Indo Neerl. V, 1858-1859. Twaalfde bijdrage vischfauna van Borneo p. 7.
2. *Brachirus macrolepis* BLEEKER, Atl. Ichth. VI, 1866 - 1872, p. 20.
3. *Brachirus macrolepis* J. R. NORMAN, Records of the Indian Museum. Vol. XXX, 1928, p. 181.
4. *Synaptura macrolepis*, WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago Vol. V, 1929, p. 171.

Fam. CLUPEIDAE.

COILIA GRAY.

Coilia coomansi nov.spec.

B. 8, D. 1. 3 - 15, A. ± 90, P. 18, V. 6 - 7, L.l. ± 60, L.tr. 10.

Elongate and compressed. Abdominal profile rounded. Dorsal profile straight from snout to dorsal and straight from dorsal to caudal, the two lines forming a very blunt angle below dorsal. Head 5, height about 5 in length. Snout prominent, somewhat shorter than eye. Maxillary pointed, reaching to end of praeoperculum. Distance from tip of snout to origin of dorsal about twice in length of anal. Ventrals inserted just before origin of dorsal, somewhat

shorter than postocular part of head. Pectorals with 10 free rays, reaching beyond origin of anal. Length of the remaining, not free rays about as long as eye and snout. 22 - 24 keeled abdonimal scutes, 9 - 10 of which are postventral. ± 33 gillrakers, more than twice as long as branchial filaments. Yellowish with a golden hue. Back pigmented. Dorsal somewhat blackish, other fins hyaline.

This Coilia-species seems to have been overlooked thus far. It was collected in several localities in the lower course of the Kapuas-river (W. Borneo) by Mr. L. COOMANS DE RUITER, to whom I dedicated this species. *Coilia coomansi* seems to be fairly common. I received 13 specimens in total. Maximum length 13 cm. Native name: I k a n g o n d j e n g.

Fam. MULLIDAE.

PARUPENEUS BLEEKER.

Parupeneus pleurospilos (BLKR.).

$D.^1$ VIII, $D.^2$ I 8, A. I 7, P. II 14, V. I 5, L.l. 30, L.tr. 2½ - 1 - 6½.

Oblong and compressed. Dorsal profile strongly arched from tip of snout to origin of first dorsal, thence slowly tapering to caudal. Ventral profile nearly straight from chin to anal. Height 3.4 in length, head 3.3. Eye 4.3 in head, twice in snout. Maxillary terminating far before eye. Teeth in both jaws in a single series, rather strong, irregular. Palate edentulous. Lower jaw somewhat shorter than upper. Two barbels extending to hindborder of operculum. Gillrakers on lower branch of first gillarch 18 + 5 - 6 rudimentary ones. Scales large, ciliated behind, present on head. First dorsal higher than second, 1.6 in height of body. Second dorsal spine flexible. Interspace between first and second dorsal about 3 scales. Second dorsal and anal subequal in height, 2.1 in height of body. Colour pink with a yellow hue, light below. A black spot below lateral line, below fifth and sixth dorsal spine. Three pearl coloured bands from snout to operculum, the middle one crossing the eye. These bands are also visible on forepart of body. Second dorsal and anal with faint longitudinal bands. Caudal lobes with crossbars.

One specimen with a total length of 103 mm from Pelabuan Ratu (Southcoast of Java), August 1933.

Literature:

1. *Upeneus pleurospilos* BLEEKER, Nat. Tijdschr. Ned. Indië V, 1853, p. 110.
2. *Upeneus pleurospilos* GÜNTHER, Cat. Brit. Mus. I, 1859, p. 407.
3. *Parupeneus pleurospilos* BLEEKER, RÉVIS. Mulloides, p. 31, Verh. Akad. Amsterdam XV. (1873) 1875. — Atl. ichth. IX, 1878, Pl. 391. fig. 5.
4. *Parupeneus luteus* KLUNZINGER, Fische Roth. Meer. 1884, p. 52 (p. parte).
5. *Pseudupeneus pleurospilos* JORDAN and SEALE, Bull. Bur. Fish. XXV. 1906, p. 276.

6. *Upeneus pleurospilos* HERRE and MONTALBAN, Philippine Journ. Sci. XXXVI. 1928, p. 128.
7. *Parupeneus pleurospilos* WEBER and DE BEAUFORT. Fishes of the Indo-Australian Archipelago Vol. VI, 1931, p. 399.

Fam. **TRACHYPTERIDAE.**

TRACHYPTERUS GOUAN.

Trachypterus semiophorus BLKR.

D. 6 - 127, P. 11, V. 7, C. 1 - 9.

Oblong, elongate, belly prominent with irregular undulating incisions. Tail strongly tapering. Height about 4 in length without tail. Head very obtuse, 5.7 in length, angle of snout very truncate. Rostronuchal profile rectilinear, strongly declivous. Eye 2.4 in head, pupil small. Small canines in lower jaw, minute conical teeth in upper. Maxillary reaching to below pupil, almost vertical, large, almost covering the whole cheek. Thin radiating lines visible in it. Opercula with strong radiating lines. Skin granular, last part of tail with deciduous cycloid scales. Lateral line with stiff spines, especially on tail. The spines on the tail are directed alternately upwards and downwards, so that the impression is given of two separate lines of spines. First dorsal situated on scarcely elevated nape, its base smaller than diameter of eye. Its rays free, about as long as total length, provided with distant membranaceous flaps, which are blackish, while the loose rays itself are white. Second dorsal connected with first, the longest rays about as long as height of body above lateral line. Longest rays about in the middle. Second dorsal ends shortly before caudal. Pectorals pointed, somewhat longer than eye. Ventrals reaching to midst of tail, rays united by finmembrane. The first ray spinulous. Caudal alternately with strong and feeble rays, the feeble ones spineless the strong ones spinulous. A very faint indication of a second ventral lobe. Caudal much longer than head. Gillmembranes connected with isthmus. Gillrakers very curious. On every gillarch two rows, an outer one and an inner one. There are eight club-shaped gillrakers in the outer row, on the lower branch of the first gillarch. Each of them bears on the top two or three bigger or smaller spines. These gillrakers are connected by a thin membrane and by a tendon. When the mouth of the fish is closed these gillrakers are bent downwards in a forward direction. When the mouth is opened they are erected by means of the tendon. The inner row counts nine gillrakers on the lower branch of the first gillarch. They are very short and strong and bear on the top one or two strong spines with occasionally some smaller ones. Nape dark. Sides silvery with irregular dark vertical bands. They become darker on the tail. On the belly only one band complete, the others on abdomen or back do not reach the lateral line. Bands on tail complete. Caudal with a large black blotch. Ventrals with a few black blotches. Dorsal and pectorals hyaline.

One specimen, caught in the Bay of Batavia in a bamboo fishtrap above a depth of perhaps 5 meter! Length 24 cm with 4 cm of the caudal included.

My specimen resembles very much the specimen of BLEEKER from Amboina, which had a length of 15 cm though it differs in some points. He did for instance not mention the scales, but these may have been overlooked. Furthermore the second dorsal is connected with the first which is not the case in BLEEKER's drawing. The ventral rays are united instead of free and he does not mention the alternating feeble and strong rays in the caudal. My specimen does not possess the ventral lobe of the caudal, only a faint indication of it was found and the dorsal lobe is only very slightly directed upwards, but has a normal position. Yet this may be due to conservation as I did not see the specimen alive. The lateral line on each side ends in the caudal and does not unite in a spine ventral of this fin as mentioned in literature. Yet this spine exists really but belongs to the caudal fin itself. The intestine is very short, the appendices pyloricae are numerous. Stomach-contents consisted of pieces of a small fish. Date: 7 January 1933.

Literature:

1. *Trachypterus semiophorus* BLEEKER, Arch. Néerl. Sc. Nat. III, 1868, p. 279.
2. *Trachypterus semiophorus* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago, Vol. V, 1929, pag. 89.

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1. *Trachypterus semiophorus* BLEEKER, Arch. Neerl. Sc. Nat. III, 1868, p. 272.
2. *Trachypterus semiophorus* WEBER and DE BEAUFORT, Fishes of the Indo-Australian Archipelago, Vol. V, 1929, pag. 89.

ADDITIONAL NOTES TO MY PAPER „THE FISHFAUNA OF THE ROKAN MOUTH".

By

Dr. J. D. F. HARDENBERG

(Laboratorium voor het Onderzoek der Zee, Batavia).

Fisheries.

In my paper, "The fishfauna of the Rokan mouth", which appeared in Treubia Vol. XIII, 1931, I have laid down the results of two visits in 1929 to Bagan si Api Api, the well known Chinese fishingtown at the estuary of the Rokanriver in Sumatra. In November 1933 I got the occasion to pay a third visit to this interesting region and found the situation much altered.

The fisheries with the so called jeremal (described in detail by me in 1931) so characteristic for the Rokan estuary has decreased very much. On the one side this decrease has been caused by the general trade slump, so that many jeremal owners could not get any profit and could not keep in repair these costly fish-traps any longer, as as a matter of fact it will cost about 30000 guilders to build a big seajeremal and several thousand guilders are required every year for repairs. On the other side the currents in the estuary have altered their direction somewhat and as a consequence of this the catches of many jeremals have decreased.

The reader of my first article will remember, that a jeremal is a V shaped fish-trap. The axis of the V is placed in the direction of the ebcurrent that drives the fish into the net which is fastened onto a rectangular wooden paling. And as it is impossible to remove a jeremal from one place to another, it is obvious that a decrease of the strength of the current or an alteration in the direction of it may have catastrophal results on the catches so that many jeremals have been abandoned.

In the place of the jeremal another fishing gear is used now. This is the so called si stji, already mentioned in my paper of 1931. I think it best to quote here, what I said of it at that time. "A si stji net is a bag-shaped net with two fine mazed wings in the shape of a V. The medial axis is placed in the direction of the current, just as is the case with a jeremal. In fact we have here a net, which catches in precisely the same manner as the jeremal, but with wings not consisting of a row of palmstems. The advantage of this over the jeremal is, that it is transportable, although when in use, it is, of course, fixed to the bottom by stakes.

Several of these nets are placed in a row side by side and each net has a length of 16 m (or 18 - 19 m) between the ends of the wings. Together they catch

much more than would be caught by a jeremal with the same width between the ends of the wings".

The si stji is much cheaper than the jeremal. In most cases ten of such nets are used together by one owner. These ten nets, which will catch about as much fish as one jeremal, will cost about 300 - 350 guilders instead of 30000. It is obvious that this method of fishing is much more economical. The costs of procuring and of repair are much less than the costs of procuring and of repair of a jeremal, and the catches, and therefore also their saling-value, are the same as catches and their saling-value of a jeremal! It is therefore not astonishing, that many jeremal owners have abandoned their jeremals and have started si stji fisheries. At the same time a much poorer class of people, the coolies, have found an opportunity to fish for their own profits.

It is obvious that the remaining jeremal owners have become anxious as to what will become of their capital invested in jeremals and by all means they are trying to convince the authorities that the si stji is disastrous for the fish-population in the Rokan-estuary, so that in a couple of years the fish-stock in this region would be totally exhausted, which would be ruinous for the fishing-town Bagan si Api Api. Serious rows between the so called jeremal-party on the one side and the si stji-party on the other side were the result.

As a matter of fact I formerly thought myself, that the jeremal owners were right when they claimed the si stji to be dangerous to the fish-population. But an exact analysis of the catches made during my last visit to Bagan si Api Api showed me, that my former opinion could not be maintained any longer. The composition of a jeremal — and of a si stjicatch — is quite the same, quantitatively as well as qualitatively. The percentage in which each given species appeared in a jeremalcatch is the same as in a si stjicatch. Also the lengths of the fishes are about the same in a jeremal as in a si stji catch. When the fishes taken in a jeremal are small, the fishes in the si stji will be small too. When large specimens are taken by the jeremal then large specimens are taken by the si stji too. Three curves of the length-variation of all specimens of *Kurthus indicus,* taken each time from a sample of a jeremal-catch compared with the length-variation of all specimens from a sample of the catch of the nearest-by si stji, will illustrate my opinion (Fig. 1, 2 and 3).

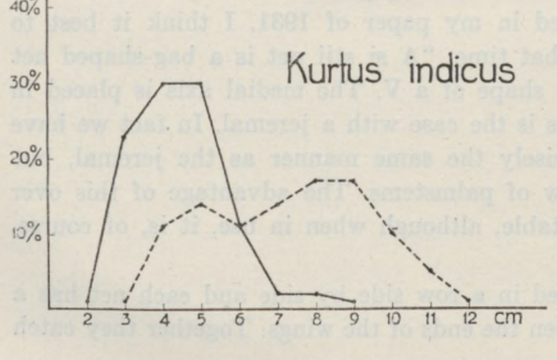

Fig. 1. — Length variation of *Kurtus indicus* in a jeremal catch compared with those of a si stji catch. On the vertical axis the number of individuals of each length is given computed in percentages from the total number of individuals of *Kurtus indicus* in the sample. On the horizontal axis is given the length in centimeter. Animals of 5.1 - 6 cm are all given as 6 cm, of 6.1 - 7 cm all as 7 cm, and so on. ——— curve of the jeremal catch. - - - - - - curve of the si stji catch.

In some cases the average-length in the si-stjicatch is even somewhat longer than in the jeremalcatch.

At any rate the curves (which are taken as an example only out of many other ones) show that the si stji will have about the same effect upon the

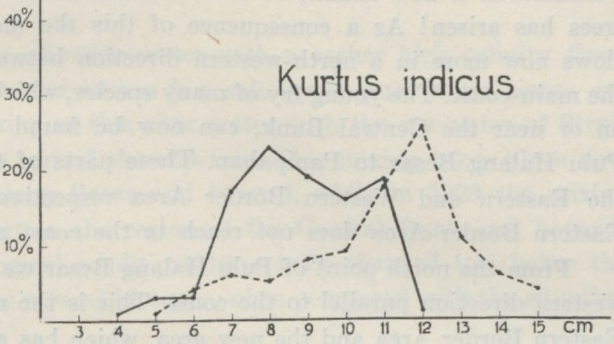

Fig. 2. — See fig. 1.

fish-population as the jeremal. Should the si stji be disastrous as said by the jeremal-owners, then their own jeremals would be the same. And until now no facts were found which pointed to overfishing. The average lengths of the fishes is about the same as in 1929. That the composition of jeremal- and si

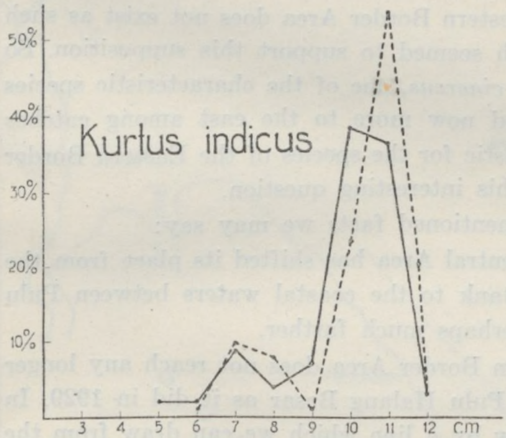

Fig. 3. — See fig. 1.

stji catches is the same, is after all not so astonishing, as the si stji catches the fish in precisely the same manner as a jeremal. Each si stji is as a matter of fact a miniature jeremal.

Alterations in oecological circumstances. (See Chart).

In my paper of 1931 I have given a chart, which shows that the Rokan-mouth can be divided into three parts according to the composition of the fishfauna. These three areas were 1st: the Central Area, 2nd: the Eastern Border Area and 3rd: the Western Border Area. These three areas do not exist any longer in the same shape as in 1929.

In the Central Area the so called Central Bank has become much higher and falls quite dry for great ranges at ebb-time. This was not the case in 1929, some small spots excepted perhaps. Not only that the bank has become higher, but it has been much enlarged also. Between Pulu Halang Besar and Pulu Perdamaran a new island, of several hectares covered with young Avicennia-trees has arisen! As a consequence of this the main current of the ebb-tide flows now more in a north-western direction between Pulu Halang Besar and the main-coast. The young fry of many species, which formerly were so abundant on or near the Central Bank, can now be found in the caostal waters from Pulu Halang Besar to Panipahan. These parts of the sea belonged in 1929 to the Eastern and Western Border Area respectively. The biocoenose of the Eastern Border Area does not reach to the coast any longer now.

From the north point of Pulu Halang Besar we can draw a line in a north-western direction parallel to the coast. This is the new border line between the Eastern Border Area and the new area, which has arisen along the coast where the catches contain much young fry. How far the above mentioned line will have to be drawn I do not now, at any rate much more to the north-west than the little village of Panipahan.

This means that the old biocoenose of the Western Border Area has changed much farther in a north-western direction than was the case in 1929. Or it may be that the biocoenose of the Western Border Area does not exist as such any longer. I found some facts which seemed to support this supposition. So for instance specimens of *Stromateus cinereus*, one of the characteristic species of the Western Border Area is found now more to the east among catches consisting chiefly of species characteristic for the species of the Eastern Border Area. I had no time to investigate this interesting question.

When recapitulating the above-mentioned facts we may say:

1: The biocoenose of my old Central Area has shifted its place from the regions on and around the Central Bank to the coastal waters between Pulu Halang Besar and Panipahan and perhaps much farther.

2: The biocoenose of my Eastern Border Area does not reach any longer to the coast between Panipahan and Pulu Halang Besar as it did in 1929. In this part of the sea it is bordered now by a line which we can draw from the north-point of Pulu Halang Besar in a north-western direction parallel to the coast.

3: The biocoenose of my old Western Border Area has shifted much to the north-west along the coast. I do not know how far, but at any rate much farther than Panipahan. It may be, however, that the old biotope of the Western Border Area does not exist any longer and that it has mixed more or less with the biocoenose of the Eastern Border Area, which has remained more or less intact.

The above mentioned transformations have been caused chiefly by the changed configuration of the Central Bank and the birth of a new island between

Pulu Halang Besar and Pulu Perdamaran. These alterations of the sea-bottom have caused the currents to take another way. Most of the riverwater flows out now in nort-western direction along Pulu Halang Besar and the coast, while in 1929 the water flowed out in a more regularly fanlike way, which is now the case only at the beginning of the ebb-tide when the Central Bank is yet submerged.

At the beginning of the ebb-tide water with a rather high salinity flows out, while at the end of it water with a low salinity or pure water comes out of the Rokan. Thus the mixing of this river-water with the sea-water of Strait Malacca occurs only at the end of the ebb-tide. This mixing takes place now in the vicinity of Pulu Halang Besar and beyond, while in 1929 the mixing occurred for the greater part in the region of the Central Bank and beyond. It is obvious that the biological conditions have been changed too, hence the shifting to other places of the several biotopes, when compared with the situation in 1929.

The reader may compare the chart (fig. 4) in this article with the chart in my former paper.

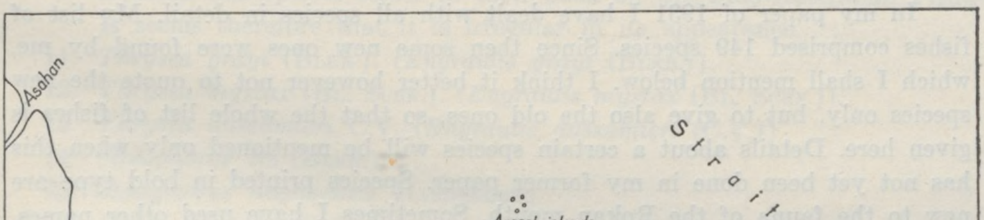

Fig. 4. — Chart of the Rokan mouth. .... seaward boundary of the fished area. ------- boundary of the bank which falls dry at low tide. ooooooo borderline between the biocoenoses of the Central Area and the Eastern Border Area.

Extension of the fished area.

The extension of the fisheries in 1929 the reader can see on the chart of my former paper on this subject. The border line shows a marked bight in a north-western direction on the submarine continuation of the Central Bank. Nowadays the fished area has much increased again in the north western direction nearly to the small islands of the Aroa-archipelago, in the midst of Strait Malacca. This extension is caused by the si stji's only, as the sea is too deep here for jeremals. The catches of these si stji's consist of the same mixture of species as occurs in the Eastern Border Area. One would expect perhaps that so far towards the middle of Strait Malacca an other composition of species would appear, but I found this not to be the case. All si stji's, also those of the most north-western parts of the fished area, will catch for the greater part the same species as the jeremals. Only *Carangids* have become more numerous, partly in species which do not occur in the region where the jeremals are fishing. The same can be said of *Leiognathus*-species.

List of the fishes occurring in the fished area in front of the Rokan mouth.

In my paper of 1931 I have dealt with all species in detail. My list of fishes comprised 149 species. Since then some new ones were found by me, which I shall mention below. I think it better however not to quote the new species only, but to give also the old ones, so that the whole list of fishes is given here. Details about a certain species will be mentioned only when this has not yet been done in my former paper. Species printed in bold type are new to the fauna of the Rokan mouth. Sometimes I have used other names, which are more up to date synonyms, instead of the ones given in my list of 1931. In these cases the old names are put between brackets.

Fam. Megalopidae (Elopsidae).

1. *Megalops cyprinoides* (BROUSSONET).

Fam. Notopteridae.

2. *Notopterus chitala* (HAM. BUCH.).
This freshwater species was caught in the river proper near the mouth near Pulu Perdamaran.

Fam. Osteoglossidae.

3. **Scleropages formosus** (MÜLL. and SCHL.).
This freshwater species was caught in the river proper near the mouth near Pulu Perdamaran.

Fam. Chirocentridae.

4. *Chirocentrus hypselosoma* BLKR.

Fam. Dussumieriidae.

5. *Dussumieria hasseltii* BLKR.
I am not sure yet whether *D. hasseltii* BLKR. and *D. acuta* C.V. can be

maintained as separate species. In that case the name of this species should be *D. acuta,* as this name is older than *D. hasseltii.* I shall deal with this question in a future paper.

Fam. Dorosomidae.

6. *Dorosoma chacunda* (Ham. Buch.).

Fam. Engraulidae.

7. *Septipinna melanochir* (Blkr.).
This species is mentioned by Weber and de Beaufort in their Fishes of the Indo-Australian Archipelago", Vol. II, p. 28. I did not see it myself.
8. *Setipinna breviceps* (Cantor).
9. *Setipinna taty* (C.V.).
10. *Thryssa kammalensis* (Blkr.) (*Engraulis kammalensis* Blkr.).
It is remarkable, that *Thryssa kammalensis,* which was so common in 1929, has become very rare now, for no apparent reason. In this respect I want to draw attention to the fact that Weber and de Beaufort, who had the disposal of a collection of fishes from the Rokan-mouth, do not mention this species either in their book on the Indo-Australian Fishes. It seems therefore that it is irregular in its appearance.
11. *Thryssa grayi* (Blkr.). (*Engraulis grayi* (Blkr.)).
12. *Thryssa mystax* (Bl. Schn.). (*Engraulis mystax* (Bl. Schn.)).
13. *Thryssa dussumieri* C.V. (*Engraulis dussumieri* (C.V.)).
14. *Stolephorus tri* (Blkr.).
15. *Stolephorus baganensis* Hardenberg.
16. *Coilia dussumierii* (C.V.).

Fam. Clupeidae.

17. *Clupeoides lile* (C.V.).
18. *Clupea toli* (C.V.).
19. *Clupea macrura* (Blkr.).
20. *Clupea kanagurta* Blkr.
I did not see this species myself. It was found by Prof. Delsman in a jeremalcatch near Panipahan (Collection de Waart 1922).
21. **Clupea brachysoma** (Blkr.).
22. **Clupea fimbriata** (C.V.).
23. *Pellona amblyuropterus* (Blkr.).
24. *Pellona ditchoa* (C.V.).
25. *Pellona pristigastroides* (Blkr.).
26. *Pellona dussumieri* (C.V.).
27. *Opisthopterus tartoor* (C.V.).
28. *Raconda russelliana* Gray.

Fam. Synodontidae.

29. **Saurida tumbil** (Bl.).

Fam. Harpadontidae (Scopelidae).

30. *Harpadon nehereus* (HAM. BUCH.) (*Harpodon nehereus* (HAM. BUCH.)).

Fam. Siluridae.

31. *Silurichthys phaiosoma* (BLKR.).
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT in their "Fishes of the Indo-Australian Archipelago", Vol. II p. 197.
32. **Hemisilurus heterorhynchus** (BLKR.).
This freshwater species was caught in the river proper near the mouth off Pulu Perdamaran.
33. **Hemisilurus scleronema** BLKR.
This freshwater species was caught in the river proper near the mouth off Pulu Perdamaran.
34. *Cryptopterus hexapterus* (BLKR.).

Fam. Plotosidae.

35. *Plotosus canius* HAM. BUCH.

Fam. Pangasidae.

36. *Pangasius nasutus* (BLKR.).
37. *Pangasius polyuranodon* (BLKR.).

Fam. Ariidae.

38. *Arius argyropleuron* C.V.
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. II p. 279).
39. *Arius maculatus* (THUNB.).
40. *Arius sagor* (HAM. BUCH.).
41. *Arius macronotacanthus* BLKR.
42. *Arius caelatus* C.V.
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. II p. 310).
43. *Arius doriae* VINC.
44. *Ketengus typus* BLKR.
45. *Hemipimelodus macrocephalus* BLKR.
46. *Osteogeneiosus militaris* (L.).

Fam. Bagridae.

47. *Macrones wolffi* (BLKR.).
48. *Macrones nemurus* (C.V.).
49. *Macrones micracanthus* (BLKR.).
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. II p. 339).

Fam. Cyprinidae.

50. *Rasbora argyrotaenia* (BLKR.).

I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. III p. 60).

51. *Leptobarbus hoevenii* (BLKR.).
52. *Osteochilus melanopleura* (BLKR.).
53. *Osteochilus spilurus* (BLKR.).
54. *Puntius hexazona* (WEBER and DE BEAUFORT).

I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. III p. 181).

55. **Balantiocheilus melanopterus** (BLKR.).

This species was caught in the river proper near the mouth off Pulu Perdamaran.

Fam. Muraenesocidae (Congridae).

56. *Muraenesox cinereus* (FORSK.).
57. *Muraenesox talabon* (CANTOR).

Fam. Neenchelidae.

58. *Neenchelys buitendijki* WEBER and DE BEAUFORT.

Fam. Ophichthyidae.

59. *Ophichthys macrochir* (BLKR.).

Fam. Belonidae.

60. *Tylosurus strongylurus* (v. HASS.).
61. *Tylosurus annulatus* (C.V.).

Fam. Hemirhamphidae.

62. *Hemirhamphus georgii* C.V.
63. *Hemirhamphus gaimardii* C.V.
64. *Hemirhamphus marginatus* (FORSK.).
65. *Dermogenys sumatranus* (BLKR.).

I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. IV p. 139).

66. *Zenarchopterus ectunctio* (HAM. BUCH.).
67. *Zenarchopterus buffoni* (C.V.).

Fam. Polynemidae.

68. *Eleutheronema tetradactylum* (SHAW).
69. *Polynemus indicus* SHAW.
70. *Polynemus dubius* BLKR.
71. **Polynemus sextarius** BL. SCHN. A few specimens in si stji catches near the Aroa-islands.

Fam. Sphyraenidae.

72. *Sphyraena* spec.

Only dried specimens seen. It was impossible to give a species name.

Fam. Mugilidae.

73. *Mugil dussumieri* C.V.

74. *Mugil cunnesius* C.V.

75. *Mugil seheli* FORSK.

76. **Mugil oligolepis** BLKR.
From a si stjicatch near Panipahan.

Fam. Atherinidae.

77. *Atherina* spec.
Only dried specimens seen, for which it was impossible to give a species name.

Fam. Ophiocephalidae.

78. **Ophiocephalus striatus** BL.
This species was caught in the river proper near the mouth off Pulu Perdamaran.

Fam. Anabantidae.

79. **Helostoma temmincki** C.V.
This species was caught in the river proper near the mouth off Pulu Perdamaran.

80. *Sphaerichthys osphromenoides* CANESTRINI.
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. IV p. 249).

81. *Betta anabatoides* BLKR.
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. IV p. 357).

Fam. Gadidae.

82. *Bregmaceros maclellandi* THOMPS.

Fam. Soleidae.

83. *Synaptura commersoniana* (LAC.) CANT.
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. V p. 168).

84. *Typhlachirus caecus* (HUBBS) HARDENBERG.
In my former paper on the fishfauna of the Rokan mouth I have called this species *Cryptops caeca,* but Prof. C. L. HUBBS informed me that the name *Cryptops* was preoccupied. Hence in my paper "Some new or rare fishes of the Indo Australian Archipelago" in Treubia Vol. XIII, I have called this species *Typhlachirus caecus* as suggested by HUBBS.

85. *Cynoglossus monopus* (BLKR.).

86. *Cynoglossus polytaenia* (BLKR.).

87. *Cynoglossus lingua* HAM. BUCH.

88. *Cynoglossus oligolepis* (BLKR.).
I did not see this species myself. It is mentioned for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. V p. 206).

Fam. Centropomidae.

89. *Lates calcarifer* (BLOCH).

Fam. Serranidae.

90. *Serranus fuscoguttatus* (FORSK.).

Fam. Theraponidae.

91. *Therapon theraps* C.V.

This species seems to be rather common in the si stji area near the Aroa islands in the middle of Strait Malacca.

Fam. Pristipomatidae.

92. *Pristipoma maculatum* (BLOCH).
93. *Pristipoma guoraca* (RUSSELL).

Fam. Chaetodontidae.

94. *Scatophagus argus* (L.).

Fam. Mullidae.

95. **Upeneus sulfureus** C.V.

A few specimens in the catches of the outer jeremals.

96. *Upeneus sundaicus* (BLKR.). (*Upenoides sundaicus* BLKR.).

Fam. Sparidae.

97. *Crenidens* spec.
98. *Proteracanthus sarissophorus* CANTOR.

Fam. Scorpaenidae.

99. *Leptosynanceia asteroblepa* BLKR.
100. *Leptosynanceia* spec.

Fam. Kurtidae.

101. *Kurtus indicus* BLOCH.

Fam. Sciaenidae.

102. *Johnius sina* (CUVIER) (*Sciaena vogleri* (BLKR.)).
103. *Johnius coiber* (HAM. BUCH.) (*Sciaena albida* (C.V.)).
104. *Johnius belengerii* (CUVIER) (*Sciaena belangeri* (C.V.)).
105. *Johnius dussumieri* (CUVIER) (*Sciaena glauca* DAY).
106. *Johnius carutta* BLOCH (*Sciaena carutta* (BLOCH)).
107. **Johnius aneus** BLOCH.

A few specimens in the catches of the outermost jeremals.

108. *Pama pama* (HAM. BUCH.) (*Sciaenoides pama* (HAM. BUCH.)).
109. *Otolithoides biauritus* (CANTOR) (*Sciaenoides biauritus* (CANTOR)).
110. *Otolithoides microdon* (BLKR.). (*Sciaenoides microdon* (BLKR.)).
111. *Otolithoides brunneus* (DAY) (*Sciaenoides brunneus* (DAY)).
112. *Otolithes maculatus* (CUVIER).

Fam. Trichiuridae.

113. *Trichiurus glossodon* BLKR.
114. *Trichiurus savala* (C.V.).

Fam. Carangidae.

115. *Megalaspis cordyla* (L.).
Mentioned also for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. VI p. 192).

116. *Atropus atropus* (BL. SCHN.).
Mentioned also for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. VI p. 202).

117. **Caranx (Selar) malam** BLKR.
In si stji catches near the Aroa islands. Sometimes in big numbers. Mentioned also for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. VI. p. 213). Mostly young specimens.

118. **Caranx (Selar) kalla** (C.V.)
In si stji catches near the Aroa islands. Sometimes in big numbers. Mentioned also for Bagan si Api Api by WEBER and DE BEAUFORT (Vol. VI. p. 216). Mostly young specimens.

119. **Caranx (Carangoides) malabaricus** (BL. SCHN.).
In si stji catches near the Aroa islands. Rare. Young specimens only.

120. *Caranx* (*Atule*) *miyakamii* WAKIYA.

121. *Alectis indica* (RÜPP.). (*Alectis major* (C.V.)).

122. *Chorinemus lysan* (FORSK.) (*Scomberoides lysan* (FORSK.)).

123. **Chorinemus tala** (C.V.).
A few young specimens in the si stji catches near the Aroa islands. It is mentioned also by WEBER and DE BEAUFORT for Bagan si Api Api (Vol. VI. p. 281).

124. *Platax* spec.

125. *Leiognathus insidiator* (BL.) (*Equula insidiatrix* (BL.)).

126. *Leiognathus ruconius* (H.B.).
Sometimes in big numbers in the si-stji catches near the Aroa islands. Mature specimens. This species is mentioned also by WEBER and DE BEAUFORT for Bagan si Api Api (Vol. VI. p. 317).

127. **Leiognathus splendens** (CUV.).
A few scattered specimens in almost every si-stji catch near the Aroa-islands. Young individuals.

128. **Leiognathus bindus** (C.V.).
Occasional specimens in the si stji catch near the Aroa-islands. Young individuals.

129. **Leiognathus berbis** (C.V.).
A few specimens in the si stji catches near the Aroa-islands and in the catches of the outermost jeremals. Young individuals.

130. **Lactarius delicatulus** (BL. SCHN.).
A few specimens in the si stji-catches near the Aroa-islands. Young.

Fam. Stromateidae.

131. *Stromateus niger* BLOCH.

132. *Stromateus cinereus* BLOCH.

Fam. Scombridae.

133. *Scomber neglectus* v. KAMPEN.
I did not see this species myself. It was found in a jeremalcatch near Panipahan by Prof. DELSMAN (Collection DE WAART, 1922).

134. *Scomberomorus kühli* (C.V.) (*Cybium kühli* C.V.).

135. *Scomberomorus guttatus* (BL. SCHN.) (*Cybium guttatum* (BL. SCHN.)).

136. *Scomberomorus lineolatus* (C.V.) (*Scomberomorus lineolatum* C.V.).

Fam. Echeneidae.

137. *Echeneis neucrates* L. (*Echeneis naucrates* L.).

Fam. Cottidae.

138. *Platycephalus insidiator* (FORSK.).

139. **Platycephalus scaber** (L.).
A single specimen in a si stji catch near the Aroa-islands.

Fam. Gobiidae.

140. *Gobius* spec.
It was not able to find the speciesname of it.

141. *Apocryptes lanceolatus* (BL. SCHN.).

142. *Periophthalmus chrysospylos* BLKR.

143. *Eleotris* spec.
I was not able to find its speciesname.

144. *Eleotris* spec.
I was not able to find its speciesname.

145. *Gobioides anguillaris* L.

146. *Gobioides cirratus* (BLYTH).

147. *Gobioides rubicundus* (HAM. BUCH.).

148. *Gobioides tenuis* (C.V.).?
I am not quite certain of this name.

149. *Trypauchen vagina* (BL. SCHN.).

150. *Trypauchen microcephalus* BLKR.

151. *Trypauchenichthys sumatrensis* HARDENBERG.

152. *Pseudotrypauchen multiradiatus* HARDENBERG.

Fam. Drepanichthidae.

153. **Drepanichthys punctatus** (L.).
A few young specimens in the si stji catches near the Aroa-islands.

Fam. Toxotidae.

154. *Toxotes* spec.
I saw a few specimens in the mouth of a small creek. As I could not catch them, I am unable to give the name of the species.

Fam. Sclerodermi.

155. *Triacanthus brevirostris.* TEMM. and SCHLEGEL.

Fam. Gymnodontes.

156. *Xenopterus naritus* RICHARDSON.

157. *Tetrodon oblongus* (BLOCH).

158. *Tetrodon fluviatilis* HAM. BUCH.

159. *Tetrodon lunaris* BL. SCHN.

160. **Tetrodon leopardus** DAY.
A single specimen in a si stji catch near Panipahan.

Fam. Carcharidae.

161. *Scoliodon sorrakowah* (CUV.) (*Carcharias laticaudus* MÜLL. and HENLE.).

162. *Carcharinus temminckii* (MÜLL. and HENLE). (*Carcharias temminckii* MÜLL. and HENLE).

163. *Carcharinus limbatus* (MÜLL. and HENLE). (*Carcharias limbatus* MÜLL. and HENLE).

164. *Physodon mülleri* (MÜLL. and HENLE). (*Carcharias mülleri* MÜLL. and HENLE).

Fam. Oryctelobidae. (Scylliidae).

165. *Stegostoma varium* (SEBA) (*Stegostoma tigrinum* (GMELIN)).

166. *Chiloscyllium indicum* (GMELIN).

Fam. Pristidae.

167. *Pristis* spec.
I saw only the saws of young animals.

Fam. Rhynchobatidae.

168. *Rhynchobatus djiddensis* (FORSK.). (*Rhynchobatus djeddensis* (FORSK.)).

169. *Rhinobatus halavi* (FORSK.). (*Rhinobatis halavi* (FORSK.)).

Fam. Narcaciontidae.

170. **Narcine timlei** (SCHNEIDER).
Two specimens, male and female, in one of the outermost jeremals.

Fam. Dasybatidae.

171. *Pteroplatea micrura* (BL. SCHN.).

172. *Dasybatus uarnak* (FORSK.) (*Trygon uarnak* (FORSK.)).

173. *Dasybatus imbricatus* (SCHNEIDER). (*Trygon walga* MÜLL. and HENLE).

174. *Dasybatus sephen* (FORSK.) (*Trygon sephen* (FORSK.)).

Fam. Myliobatidae.

175. *Aëtomylaeus maculatus* (GRAY and HARDW.). (*Myliobatis maculatus* GRAY and HARDW.).

176. *Aëtobatus narinari* (EUPH.).

SOME REMARKS ON THE GENUS STOLEPHORUS LACÉPÈDE IN THE INDO-AUSTRALIAN ARCHIPELAGO

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I. INTRODUCTION.

The species of the genus *Stolephorus* are fishes which prefer coastal and estuarine waters, where some may live in salinities as low as 10 - 15$^{0}/_{00}$. In fact they are caught along the shores only and their planktonic eggs are rarely found far out at sea (See DELSMAN, Treubia Vol. XIII 1931).

The so-called Ikan teri (Java) or Ikan bilis (Sumatra, Borneo) is highly esteemed by the natives and large quantities are caught daily, which are consumed either in a fresh or in a dried and salted condition. A special product are the wellknown Red or Macassar fishes, an ingredient of the rice-table, having a taste more or less like that of the European anchovy. It is coloured red by a fungus, *Monascus purpureus* WENT, which is added to it during the preparation.

Ikan teri is caught by two methods of fishing, viz. by the so-called sero's or kèlongs, bamboo fishtraps near the coast, which may attain a big seize, and by the so-called pajangnet. A pajangnet is a kind of purse-seine which is pulled round a shoal sighted from the fishingboat.

WEBER and DE BEAUFORT in their "Fishes of the Indo-Australian Archipelago" mention five species of the genus *Stolephorus*, viz. *Stolephorus heterolobus, zollingeri, commersonii, indicus* and *tri.* All these species have already been recognized by BLEEKER and all, except *St. zollingeri,* seem to have a very wide range of distribution, reaching far outside the Indo-Australian Archipelago from Tahiti to Madagascar.

Now Prof. DELSMAN, when investigating the planktonic *Stolephorus*-eggs (See DELSMAN, Treubia Vol. XIII 1931), found more kinds of eggs than there are species according to the literature, so that he felt inclined to suppose that there are more Indian species of *Stolephorus* than have been described thus far. A thorough enquiry at the different fishmarkets showed me that this supposition was right. Several unknown species were found. Examination of samples of each species from different parts of the Archipelago showed, moreover, that each species could be split up into smaller units. The results of my investigations are laid down in this article.

II. BIOLOGY.

Not so very much is known yet about this subject.

Stolephorus species are fishes with pelagic habits, though they seem not to go outside the coastal waters. They mostly swim in small shoals but some of them seem to live solitarily for a certain time.

The smaller species, as *Stolephorus zollingeri, heterelobus* and *insularis,* live in shoals of a few hundreds or thousands of individuals. The bigger species, especially *St. indicus* and *commersonii,* known as teri glagah, seem to lead a more solitary life, as in the catches of the fishermen a few occasional individuals only occur as a rule. It is only during the months June-August that these species are captured in small shoals. The single individuals seem to gather during the full east-monsoon and then form small shoals of at the utmost 100 - 200 individuals (as far as the north-coast of Java is concerned: I have not sufficient data from other islands).

These fishes seem not to gather for spawning purposes in this case as they spawn all the year round, as shown by the study of pelagic eggs and in the case of *Stolephorus indicus,* the specimens captured are practically all immature.

However, it may be that the single individuals taken in the other months are stray specimens only and that the bulk of the adult specimens, as well as the immature ones live in shoals somewhat farther out at sea out of reach of the fishermen.

Some evidence of the existence of a periodical migration may be drawn from certain observations. Thus, for instance, shoals of a *Stolephorus* species appear in the neighbourhood of the Karimon-Djawa islands in the Java-sea during the full East-Monsoon (July-August). I do not know to which species my information refers, as I did not succeed in getting a sample from these islands, in spite of several vain attemps; but the fishes belong most probably to *St. indicus* or *commersonii.* Along the north coast of Java a maximum in the catches of all *Stolephorus* species may be noted during the above named months. Especially the catches of *Stolephorus indicus* and *commersonii* show an increase then (see above). This is also the case with *Stolephorus heterolobus* and *insularis,* which are common during the whole year, whereas *St. indicus* and *commersonii* are rather rare in the remaining months.

In the seas between Singapore and Bangka, east of Sumatra a migration is still much more evident. Thus on the north-coast of Bangka *Stolephorus pseudoheterolobus* is caught only at the end and the beginning of each year viz. October-February (March), in the full West-monsoon.

In the Lingga-Archipelago, north of Bangka, *Stolephorus pseudoheterolobus* and *insularis* are caught only during the months February-August, with a maximum in July-August. More northward, in the Riau-Archipelago, these species are caught only in the months April-October. They arrive therefore two months later and disappear again two months later.

Considering these facts one feels tempted to conclude that a northward migration can be traced.

How far this migration reaches and which way the fishes come back is not known yet. A detailed study with material much larger than mine would be necessary to solve this problem.

For what is known about the spawning habits I refer to the above mentioned article of DELSMAN. As is the case with many fishes they spawn some time before midnight and during the whole year. Though the adult and the young fishes go into brackish water, the planktonic eggs are not found in water with a salinity less than $\pm$ 17⁰/₀₀.

The food consists of pelagic organisms, though the composition is not the same for the different species.

Thus the smaller species, for instance *Stolephorus heterolobus* and *pseudoheterolobus,* feed chiefly on the different small *Crustaceans* as *Copepods, Ostracods,* small specimens of *Mysis, Sergestes* and *Euphausia* and, of course the *Nauplius* and *Zoeä*larvae. Furthermore I found in their stomachs other small plancton organisms in a greater or lesser abundance, e.g. small *Bivalves* and *Gastropods* in their planctonic stage, *Annelids* and *Pteropods* and also some *Diatoms,* the latter in *St. pseudoheterolobus* more regularly than in *St. heterolobus.*

Stolephorus tri, baganensis and *insularis* feed especially on fullgrown specimens of *Mysis* and *Sergestes.* Of other organisms only an occasional *Copepod* was found. These three species, which can be distinguished easily from the other species of *Stolephorus* by the high and more or less compressed body, seem to belong therefore to the same biological group.

Big species as *Stolephorus indicus, commersonii* and big specimens of *insularis* feed for the greater part on fishlarvae together with some *Sergestes* and *Mysis.*

The food of *Stolephorus zollingeri* and *celebicus* is imperfectly known yet; as I could only recognize remains of *Copepods* and of some bigger *Crustaceans* (*Sergestes*?).

Of course the above data apply only to full grown specimens. Young specimens of all species feed on small *Copepods* and *Diatoms* and similar organisms.

III. DESCRIPTION OF THE SPECIES.

As pointed out above, I found several more species than mentioned by WEBER and DE BEAUFORT. As I did not find any description which fitted my species, I must assume that they are new.

I will give in the first place a dichotomic table afterwards to be followed by a description of the different species.

The latter may be arranged into a number of groups containing species showing a closer mutual relationship.

Thus *Stolephorus heterolobus* and *pseudoheterolobus* are easily recognizable by their long, slender body, their short maxillaries and by the position of the anal fin.

Stolephorus zollingeri and *celebicus* can at once be identified by their long slender heads and by the maxillaries which have a rounded extremity, all other species in the Indo Australian Archipelago having pointed maxillaries. That these two species form a natural group within the genus also follows from the very high number of praecaudal vertebrae.

The group of *Stolephorus tri* and *baganensis* is distinguished by the very high and compressed body and by a little spine in front of the dorsal fin. In these two respects they approach the genus *Thryssa*.

The three remaining species, *Stolephorus indicus, commersonii* and *insularis* do not seem to have any close relationship as far as can be concluded from the external features. Yet according to the investigations of DELSMAN (See Treubia Vol. XIII 1931) on the planctonic eggs these three species have in common a very characteristic knob on the animal extremity of the egg membrane, so that they also seem to form a natural group. All the other species. have no such knob.

Looking at the numbers of vertebrae we find the above subdivision into four groups confirmed:

	Vertebrae	Difference	
St. baganensis	19 + (19 – 20) = 38 – 39	0 – 1	I
St. tri	19 + 19 = 38	0	
St. insularis	20 + 19 = 39	1	II
	20 + 20 = 40	0	
	21 + 20 = 41	1	
St. indicus	21 + 20 = 41	1	
	22 + 21 = 43	1	
St. commersonii	20 + 19 = 39	1	
St. heterolobus	22 + 20 = 42	2	III
St. pseudoheterolobus	23 + 20 = 43	3	
St. celebicus	24 + (19 — 20) = 43 — 44	4 — 5	IV
St. zollingeri	(24 — 25) + 18 = 42 — 43	6 — 7	

The same holds for the configuration of the scales as shown by fig. 10. At least three types may be distinguished here, answering to the groups I, II and III + IV resp.

Also the results of the study of the pelagic eggs in general tally with the above, those of group I being characterized by an oil-globule, those of group II by a terminal knob on the egg-membrane, whereas those of groups III and IV probably have no oil-globule and no knob, with the exception, however, of *St. heterolobus* where a very small oil-globule is present.

Key to the species I [1]).

1. Plantonic eggs with a knob (recognizable also in ripe ovaria) .... 2.
   Planctonic eggs without a knob .... 4.
2. Maxillary reaching to mandibulary joint .... *St. indicus.*
   Maxillary reaching to gillopening .... 3.
3. A double pigment-line from head to dorsal .... *St. commersonii.*
   No pigment-lines .... *St. insularis.*
4. Difference between the numbers of praecaudal and caudal vertebrae 4 or more. End of maxillary rounded .... 5.
   Difference between numbers of praecaudal and caudal vertebrae 3 or less. End of maxillary pointed .... 6.
5. Abdominal spines present .... *St. zollingeri.*
   Abdominal spines absent .... *St. celebicus.*
6. Number of vertebrae more than 40 .... 7.
   Number of vertebrae less than 40 .... 8.
7. Distance tip of snout to back-end of maxillary 4.0 - 4.3 in length. Height 5.1 - 5.6 .... *St. heterolobus.*
   Distance tip of snout to back-end of maxillary 4.4 - 4.7 in length. Height 6.0 - 6.2 .... *St. pseudoheterolobus.*
8. Two broad pigment-lines from head to dorsal .... *St. tri.*
   No broad pigment-lines from head to dorsal .... *St. baganensis.*

Key to the species II [2]).

1. Maxillary extending to gillopening .... 2.
   Maxillary extending to mandibulary joint .... 5.
2. A double pigment line on the back .... 3.
   No pigment lines on the back .... *Stolephorus insularis.*
3. Pigment lines from head to caudal (two broad ones from head to dorsal. Two narrow ones from dorsal to caudal) .... *Stolephorus tri.*
   Pigment lines not so .... 4.
4. Two broad pigment lines from head to dorsal ...... *Stolephorus commersoni.*
   Two narrow pigment lines from dorsal to caudal ... *Stolephorus baganensis.*
5. End of maxillary pointed .... 6.
   End of maxillary rounded, truncated .... 8.
6. Origin of anal below dorsal .... *Stolephorus indicus.*
   Origin of anal behind dorsal .... 7.
7. Distance tip of snout to back end of maxillary 4.0 - 4.3 in length. Height 5.1 - 5.6 in length .... *Stolephorus heterolobus.*

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[1]) In this table the natural relationship has been put forward.

[2]) In this table only the external characters are used, so that it does not always express the natural relationship of the species.

Distance tip of snout to back end of maxillary 4.4 - 4.7 in length. Height 6.0 - 6.2 in length .... *Stolephorus pseudoheterolobus.*

8. Head 4 - 4.5 in length. Abdominal spines present. Distance tip of snout-back end of maxillary 6.3 - 6.5 in length .... *Stolephorus zollingeri.*
Head 3.4 - 4 in length. No abdominal spines. Distance tip of snout-back end of maxillary 4.5 - 4.7 in length .... *Stolephorus celebicus.*

Stolephorus tri (BLKR.). Fig. 1.

D. I 14 - 16; A. 20 - 22; P. 12 - 14; V. 7; L.l. 32 - 35; L.tr. 9.

Head 4.0, height 4 - 4.3 in length [1]). Eye 3.4 - 3.8 in head. Snout about three quarters of eye. Maxillary reaches to gillopening, somewhat dilated above mandibulary joint, pointed. Origin of dorsal in the middle between tip of snout and first rays of caudal or somewhat behind it. A small spine in front of dorsal. Ventrals inserted before dorsal in the middle between origin of anal and root of pectorals. Distance origin of anal — root of caudal about as long as the distance origin of anal — gillopening. Anal as long as head without snout or a little shorter, 5.1 - 5.6 in length, its origin below dorsal. Ventrals ½ - ⅔ of pectorals. Pectorals about as long as lower jaw, nearly reaching to root of ventrals, and reaching to midst of pupil. Gillrakers 18 - 22 [2]). 4 - 7 abdominal scutes, the last one always near root of ventrals. When there are less than 7 scutes a gap is found between the three, four or five foremost ones and the last one. (See Fig. 11). Scales rather deciduous, striated, in the middle somewhat broken. (See Fig. 10a). A silvery lateral band on the sides. Black spot on occiput. Two broad lines composed of small pigment-spots from occiput to dorsal and two thin ones from dorsal to caudal. Sides of the back somewhat pigmented. When alive the sides and the caudal are more or less yellow. Fins hyaline, caudal powdered with black, hindborder black. Planctonic eggs oval shaped with an oil-globule (See DELSMAN Treubia Vol. XIII). Maturity is reached at a length of about 9 cm (total length). Largest specimens ± 12 cm (tail included).

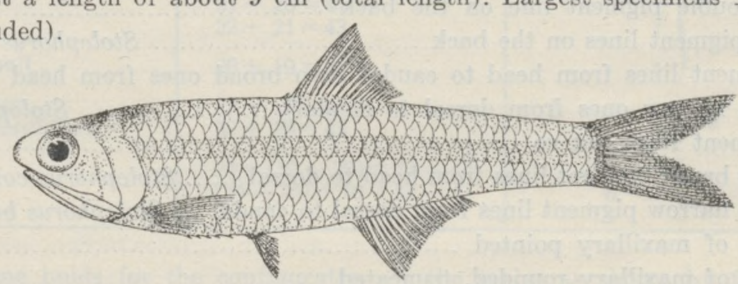

Fig. 1. — *Stolephorus tri.*

A rather high sized and compressed species, easily recognizable by the two sets of pigment lines on the back. Found in great quantities near the big rivermouths of Sumatra and of Borneo, not in water with a salinity less than 25⁰/₀₀. Along the Java-coast rare, probably because such big rivers as in Sumatra

[1]) In this and all other cases the caudal fin is excluded.
[2]) Only the gillrakers on the lower branch of the first gillarch are counted.

and Borneo are lacking here. I found it rather regularly, though in small numbers only, in the bight of Cheribon and near Grissee near the Solo-river. I got this species from the following places; Java (Batavia, Tjilamaja, Cheribon, Sawoh Djadjar. Tuban, Grissee), Sumatra (mouth of the Indragiririver, mouth of the Rokan-river, mouth of the Musi, Tandjong Balei, Bengkalis, Belawan-Deli), Borneo (Kumai). According to the literature a widespread species, occuring from the Philippines to Bombay, but it may be that in some of the localities cited it has been mistaken for *Stolephorus baganensis*.

Stolephorus baganensis HARDENBERG [1]) Fig. 2.

D. I. 14 - 16; A. 19 - 21; P. 12 - 14; V. 7; L.l. 35 - 37; L.tr. 8 - 9.

Head 4.1 - 4.4. Height 3.7 - 4.0 in length. Eye 3.2 - 3.6 in head. Snout twice in eye or less. Maxillary reaches to gillopening, dilated above mandibulary joint, pointed. Origin of dorsal somewhat behind the middle between tip of snout and first rays of caudal. A small spine in front of dorsal. Ventrals inserted before dorsal, about midway between origin of anal and root of pectorals. Distance origin of anal — root of caudal about equal to the distance origin of anal — midst of operculum. Anal as long as head or somewhat shorter, 4.4 - 4.6 in length, its origin below dorsal. Ventrals ⅔ of pectorals. Pectorals reaching to midst of pupil. Gillrakers 20 - 29, according to the localities. 5 - 8 abdominal scutes, the last one mostly inserted before the ventrals. Scales not deciduous, striated, in the middle finely broken. (See Fig. 10b). A silvery lateral band on the sides. Black spot on occiput. Two thin lines of small pigment-spots on the back from dorsal to caudal. Sides of the back somewhat pigmented. Fins hyaline. Caudal bordered with black. Planctonic eggs oval shaped, with an oil-globule. (See DELSMAN Treubia Vol. XIII). This species is mature at a length of about 7 cm. Largest specimens 10 - 11 cm.

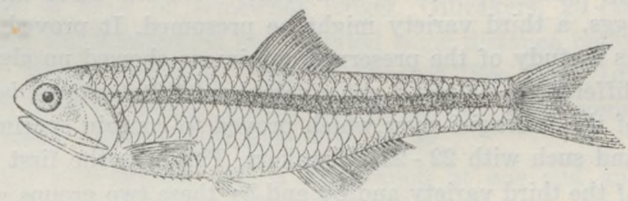

Fig. 2. — *Stolephorus baganensis baganensis.*

This high-sized and compressed species is nearly related to the foregoing. *Stolephorus tri* (BLKR.) and indeed it has been confounded with it. So, for instance, I would not wonder if, WEBER and DE BEAUFORT, who mention *St. tri* for Bagan si Api Api, did not see that species, but *St. baganensis*, as, according to my own experience, *St. tri* is very rarely caught there (See HARDENBERG Treubia Vol. XIII). It can, however, easily be recognized from *St. tri* by the pigment lines on the back (cf. also the drawings of the scales). *St. baganensis* is also an aestuarine form and goes much farther into the brackish water than *St. tri*.

[1]) Described in Natuurkundig Tijdschrift van Nederlandsch-Indië, Deel XCIII, 1933.

As a fact it can be found regularly in big rivermouths, but along the Javacoast, which has no big rivers, it is only occasionally found, the bight of Cheribon and the mouth of the Soloriver excepted, as is the case with *St. tri*. I got it from the following places; Java (Labuan, Batavia, Cheribon, Kendal, Semarang, Tuban, Grissee, Surabaja, Tjilatjap), Sumatra (Lucipara, Mouth of the Musi, mouth of the Indragiri, Bengkalis, Bagan si Api Api, Panei-river, Tandjong Balei, Labuan Deli), Borneo (Kumai). Hitherto known with certainty from the Indo-Australian Archipelago only, but probably it may occur along the coast of Malacca and Siam also.

Stolephorus baganensis is, at closer examination, to be divided into several smaller units. Most of them are to be distinguished by statistical methods only. Yet, there is one exeption and I have hesitated, whether I should give it a specific rank of its own or not.

When Dr. DELSMAN studied the planctonic eggs of what he, at that time, called *Stolephorus tri* in accordance with WEBER and DE BEAUFORT, he found regularly three types of eggs in front of the rivermouths. At his request I examined the *Stolephorus* specimens from these rivermouths closer and soon found that the so-called *St. tri* consisted of at least two clearly recognizable species, viz. the true *St. tri* and what I have described above as *St. baganensis* (called after Bagan si Api Api, the first place where I found this species in big numbers). But in accordance with the three different kinds of planctonic eggs, a third variety might be presumed. It proved not easy to find this out, as a study of the preserved specimens showed no clear taxonomic or statistical differences. At last I got a sample of "*Stolephorus baganensis*" from the mouth of the Indragiri-river which proved to contain specimens with 19 - 20 gillrakers and such with 22 - 23 gill-rakers. This was the first indication of the existence of the third variety and by and by these two groups were found again in several big rivermouths of Sumatra. Specimens with 19 - 20 gillrakers had a somewhat bigger pupil and so it was provisionally called the variety "*macrops*" in the paper on the planctonic eggs of the genus *Stolephorus* by DELSMAN. Later on I found a taxonomic difference in the shorter anal fin of "*macrops*".

When alive the two varieties can be distinguished at a single glance by the colour of the tail. *Stolephorus baganensis* having the caudal yellowish with a black border and *macrops* whitish with a black border. Unfortunately these differences disappear very soon after death.

I propose, therefore, in accordance with the above, to call the third variety, *Stolephorus baganensis macrops* which includes that the *St. baganensis* proper has to be named *St. baganensis baganensis*. The variety *macrops* is very much like to *St. baganensis* proper. The statistical differences are given below. The only reliable taxonomic difference in preserved material is the shorter anal fin of "*macrops*" which goes 5 - 5,5 in length (in *St. baganensis* about 4,5). The bigger pupil can be distinguished only when both two varieties are at hand.

The configuration of the scales shows much less separate "cells" than with *Stol. baganensis baganensis* and resembles very much those of *St. tri.* (See Fig 10c).

The var. *macrops* seems to be the saltwater variety of *St. baganensis,* whereas *baganensis* proper frequents the more brackish inner parts of the river-mouths. *Macrops* is therefore much rarer in the catches of the fishermen as they live farther out but, judging from the numbers of the planctonic eggs both varieties seem to be equally common. The eggs of *baganensis* proper are found in water with a salinity of 17 - 28⁰/₀₀, and the eggs of *macrops* in water with a salinity of 28⁰/₀₀ and more (DELSMAN, Treubia XIII).

Stolephorus insularis HARDENBERG [1]). Fig. 3.

D. 16 - 17; A. 20 - 23; P. 12 - 14; V. 7; L.l. 37 - 38; L.v. 9 - 10. Head 3.8 - 4.3, height 4.5 - 5.0 in length. Eye 3.1 - 3.6 in head. Snout about three quarters of eye. Maxillary reaches to gillopening, dilated above mandibulary joint, pointed. Origin of dorsal somewhat behind the middle between tip of snout and first rays of caudal. Ventrals inserted before dorsal, in the middle between origin of anal and root of pectorals. Distance origin of anal-root of caudal about as long as the distance origin of anal to gillopening or to mandibulary joint. Anal about as long as head without snout, 4.9 - 5.3 in length, its origin below dorsal. Ventrals ⅔ of pectorals. Pectorals not reaching ventrals, as long as postorbital part of head or somewhat longer. Gillrakers, 20 - 26. 4 - 7 abdominal spiny scutes, the hindermost one situated some distance before the ventrals (See Fig. 11). Scales deciduous, scarcely striated (See Fig. 11d). A silvery lateral band from head to caudal. Black spot on occiput. Back somewhat pigmented. Fins hyaline, caudal powdered with black.

The planctonic eggs are oval-shaped with a little knob at one end and without an oil-globule (See DELSMAN Treubia Vol. XIII). Maturity is reached at a length of about 6 - 7 cm (total length). Largest specimens 10 - 11 cm (tail included).

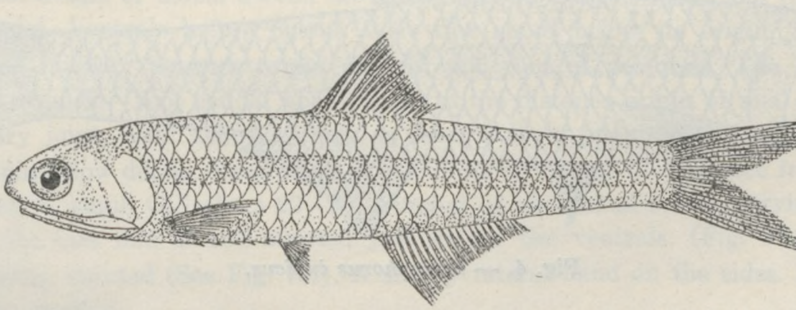

Fig. 3. — *Stolephorus insularis.*

[1]) Described by me for the first time in Natuurkundig Tijdschrift voor Nederlandsch-Indië, Deel XCIII, 1933.

This species can be divided into several smaller units. Differences are found in the numbers of gillrakers and in the number of vertebrae. I will deal with this question below. I found also indications of differences in the length at which maturity is reached (See page 341).

Stolephorus insularis can be found regularly along the Java-coast in small numbers (in pure shoals or mixed with other *Stolephorus*-species), but it seems to occur especially near islands at some distance from the coast, as the Lingga-archipelago, Bawean and Kangean-archipelago. It is for this reason, that I have given it the name *insularis*.

I got specimens from the following localities: Java (Labuan, Tjarita, St. Nicolaaspoint, Bantam, Batavia, Tjiparage, Tjilamaja, Indramaju, Cheribon, Sawudjadjar, Kendal, Semarang, Tuban, Kelampis, Pasuruan, Puger, Tjilatjap, Pelabuan Ratu, Bawean, Kangean), Sumatra (Lingga-archipelago, Tandjong Balei, Labuan Deli, Mouth of the Musi), Borneo (Kumai), Celebes (Macassar, Menado) and Singapore. This species is hitherto only known from the Indo-Australian Archipelago.

5. **Stolephorus indicus** (v. HASS.). (See Fig. 4).

D. 16 - 17; A. 20 - 21; P. 14 - 16; V. 7; L.l. ± 40; L.tr. 9.

Head 4.1 - 4.4, Height 5.4 - 5.8 in length. Eye 3.4 - 3.8 in head. Snout about as long as or somewhat shorter than eye. Maxillary reaches to mandibulary joint or somewhat behind it, dilated posteriorly, pointed. Distance tip of snout — backend of maxillary about 5.3 - 5.6 in length, 1.3 in head. Origin of dorsal behind the middle between tip of snout and first rays of caudal. Ventrals inserted before dorsal, their tips reaching to below origin of dorsal, situated in the middle between origin of anal and root of pectorals. The distance origin of anal — root of caudal is about equal to the distance origin of anal — interoper-

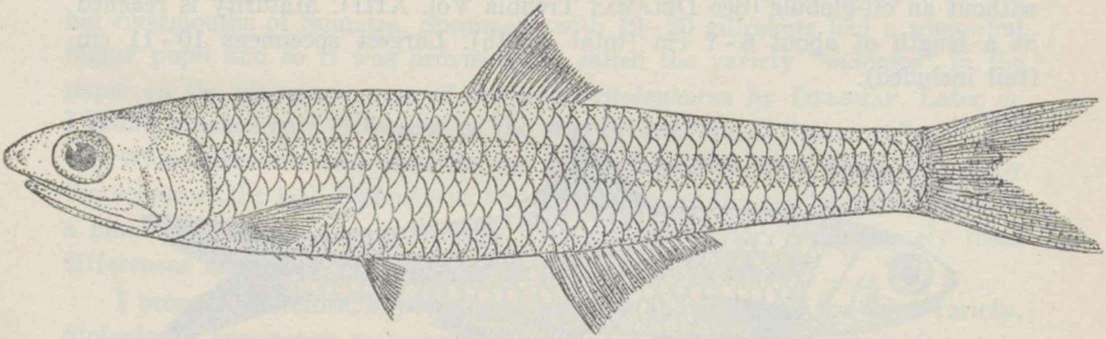

Fig. 4. — *Stolephorus indicus.*

culum. Anal about as long as lower yaw, 6.0 - 6.4 in length, its origin below dorsal. Ventrals ⅔ of pectorals. Pectorals somewhat longer than postorbital part of head. Gillrakers 21 - 23. 4 - 6 abdominal scutes, the hindermost one situated far in front of the ventrals (Fig. 11). Scales very deciduous, scarcely

striated (Fig. 10e). A silvery lateral band on the sides. A black spot on occiput. Back and caudal fin powdered with black. Other fins hyaline. Planctonic eggs oval shaped with a little knob at one pole. Maturity is reached at a total length of about 14 - 15 cm or 17.5 cm according to the variety. Largest specimen known 17.5 cm.

Stolephorus indicus resembles in shape very much *St. commersonii,* but it may be distinguished from the latter by the absence of the pigment lines on the back and by the shorter maxillary. It is a solitarily living species, which can be found during the whole year in small numbers along the Java coast where it is most common in July-August (see *St. Commersonii*). Sometimes it enters the tidal rivers of Sumatra and Borneo.

The individuals of this species can be divided into two groups with 43-or 41 vertebrae respectively. The individuals of the first group are ripe at a length of about 17.5 cm, being the biggest specimens of *Stolephorus* found in the Archipelago. I got only twice a ripe specimen and each time near the mouth of the Musi-river. Specimens of the second group remain smaller and are ripe at a length of 14 - 15 cm. I found no taxonomic differences between the two groups and the range of distribution seems to be the same, although the smaller individuals are more common.

I got specimens from the 43- group from the following places; Java (Bantam, Batavia, Tjilamaja, Cheribon, Kendal, Semarang, Rembang, Kelampis), Borneo (Kumai), Sumatra (Sunsang); and specimens from the 41 group from Java (Tjarita, Batavia, Cheribon, Tuban, Kelampis, Wijnkoopsbay), Sumatra (Olehleh Belawan Deli), Celebes (Macassar). A wide-spread species occuring from British India to Japan and Tahiti.

Stolephorus commersonii LAC. (See Fig. 5).

D. 15 - 17; A. 20 - 21; P. 14 - 15; L.l. 37 - 39; L.tr. 9.

Head 3.8 - 4. Height 4.6 - 5.0 in length. Eye 3.1 - 3.3 in head. Snout shcrter than eye. Maxillary reaches to gillopening, dilated above mandibulary joint, pointed. Origin of dorsal behind the middle between tip of snout and first rays of caudal. Ventrals before dorsal, their tips about below its origin. Ventrals inserted midway between origin of anal and root of pectorals. The distance origin of anal — root caudal about equal to the distance origin of anal — mandibulary joint. Anal about as long as head without snout, 4.7 - 5.1 in length, its origin below dorsal. Ventrals ⅔ of pectorals as long as the distance from gillopening to pupil. Gillrakers 22 - 25. Number of abdominal scutes varying from 0 - 6, the last one is not inserted just before the ventrals. (Fig. 11) Scales deciduous, striated (See Fig. 10f). A silvery lateral band on the sides. A black spot on occiput.

Two broad lines composed of small pigmentspots from occiput to dorsal. Sides of the back and back behind the dorsal somewhat pigmented. Fins hyaline, caudal powdered with black.

Planctonic eggs oval shaped with a small knob at one end and without an oil-globule. Maturity is reached at a length of about 10 cm. Largest specimens about 12.5 cm.

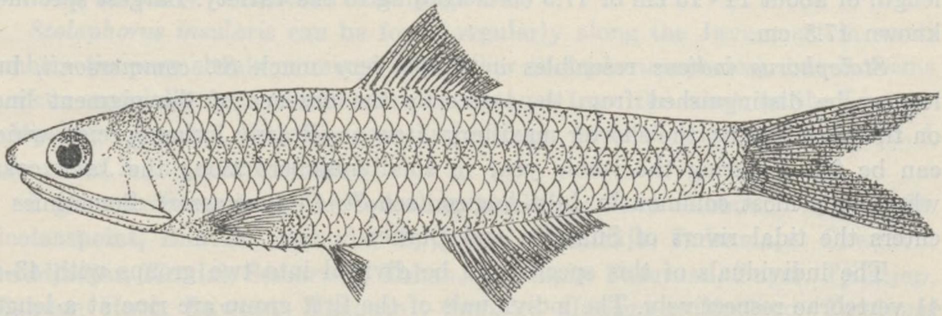

Fig. 5. — *Stolephorus commersonii.*

Stolephorus commersonii can be distinguished easily from the other species by the two pigment-lines, reaching from the occiput to the dorsal fin only, instead of reaching from the occiput to the caudal fin (*St. tri*) or from the dorsal to the caudal fin (*St. baganensis*). This species seems to live more or less solitarity and is found along the Java-coast during the whole year where, however, it is common during July and August only. Sometimes it seems to enter tidal rivers, but at any rate it requires a high salinity.

I got specimens from the following places: Java (Labuan, Batavia, Kendal, Semarang, Surabaja, Kelampis, Tjilatjap), Sumatra (Sunsang, Belawan-Deli), Borneo (Kumai, Pontianak). A widespread species occuring from the Philippines to Madagascar.

Stolephorus heterolobus RÜPP. (See Fig. 6).

D. 14 - 15; A. 16 - 19; P. 14; V. 7; L.l. ± 36; L.tr. 8 - 9.

Head 3.4 - 3.8, height 5.1 - 5.6 in length. Eye 3.3 - 3.7 in head. Snout shorter than eye. Maxillary reaches to somewhat behind mandibulary joint, dilated posteriorly, pointed. Distance tip of snout-backend of maxillary 4.0 - 4.3 in length, 1.2 in head. Origin of dorsal somewhat behind the middle between tip of snout and first rays of caudal. Ventrals inserted before origin of dorsal, midway between origin of anal and root of pectorals. Distance origin of anal-root of pectorals about equal to the distance origin of anal-back end of maxillary or a little shorter. Anal about 6.0-6.6 in length or as long as lower yaw, its origin behind dorsal. Ventrals ⅔ of pectorals as long as postorbital part of head or somewhat longer. Gillrakers 22 - 23. 4 - 6 abdominal scutes, the last one not in front of ventrals (Fig. 11). Scales

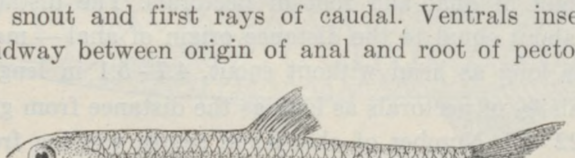

Fig. 6. — *Stolephorus heterolobus.*

deciduous, scarcely striated (See Fig. 10g). A silvery lateral band on the sides. A black spot on occiput. Back and caudal fin powdered with black. Other fins hyaline. Plantonic eggs oval shaped, with small, yellow, oil-globule. Maturity is reached at a total length of about 6.5 cm. Largest specimens 8 - 9 cm.

Stolephorus heterolobus is very common close along the Javacoast, where it lives in unmixed shoals and where it is caught in great quantities during the whole year. The sea in front of the big rivermouths is avoided and neither did I find it in the Riau and Linggaarchipelago, where it is replaced by a nearly related form, viz. *Stolephorus pseudoheterolobus.* I got specimens from the following places: Java (Labuan, Tjarita, St. Nicolaaspoint, Bantam, Batavia, Tjiparage, Tjilamaja, Indramaju, Cheribon, Sawuhdjadjar, Semarang, Japara, Kelampis, Pasuruan, Puger, Tjilatjap, Wijnkoopsbay), Kangean-archipelago, Singapore, Bali (Buleleng). A wide-spread species occurring from the Red Sea to Australia.

Stolephorus pseudoheterolobus HARDENBERG [1]). (See Fig. 7).

D. 14 - 15; A. 16 - 18; P. 13 - 14; V. 7; L.l. 38; L.tr. 9.

Head 3.8 - 4.2, height 5.6 - 6.2 in length. Eye 3.5 - 4 in head. Snout somewhat shorter than eye. Maxillary reaches to somewhat behind mandibulary joint, dilated posteriorly, pointed. Distance tip of snout — back end of maxillary 4.4 - 4.7 in length, 1.2 in head. Origin of dorsal in the midst (or somewhat behind it) between tip of snout and first rays of caudal. Ventrals inserted before dorsal, in the middle between origin of anal and root of pectorals. Distance origin of anal — root of caudal equal to the distance origin of anal — root of pectorals or gillopening. Anal 5.8 - 6.2 in length, about as long as lower jaw, its origin behind dorsal. Ventrals ⅔ of pectorals. Pectorals about as long as postorbital part of head. Gillrakers 23 - 25. 4 - 6 abdominal scutes, the last one remote from the ventrals (Fig 11). Scales very deciduous, scarcely striated (See Fig. 10h). A silvery lateral band on the sides. A black spot on occiput. Back and caudal fin powdered with black. Other fins hyaline. Planctonic eggs oval shaped, without oil-globule. Maturity is reached at a total length of about 6.5 cm. Largest specimens 10 cm.

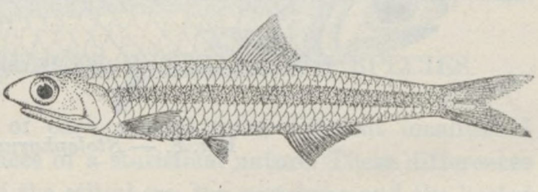

Fig. 7. — *Stolephorus pseudoheterolobus.*

Stolephorus pseudoheterolobus is much rarer than *St. heterolobus.* Along the Java-coast it is caught only occasionally though, somewhat further in sea, the eggs are caught regularly. In the Riau- and Lingga-archipelago it is com-

[1]) Described by me for the first time in Natuurkundig Tijdschrift voor Nederlandsch-Indië, Deel XCIII, 1933.

mon, whereas *St. heterolobus* was not found there by me. It seems therefore, that the two species replace each other more or less. In the waters north of Banka and in the Riau-Lingga-archipelago there are indications of a periodical migration (see above), but this needs further confirmation. I got specimens from the following places: Java (Tjarita, Bantam, Batavia), Sumatra (Muntok, several places in the Riau- and Lingga-archipelago), Celebes (Macassar, Menado and Amboina).

The species is thus far known from the Indo-Australian Archipelago only.

Stolephorus zollingeri (BLKR.). (See Fig. 8).

D. 13 - 14; A. 12 - 13; P. 13 - 14; V. 7; L.l. ? [1]) L.tr. 8 - 9.

Head 4.0 - 4.5, height 6.0 - 6.3 in length. Eye 3.0 - 3.2 in head. Snout shorter than eye. Maxillary reaches to mandibulary joint, dilated posteriorly, truncated. Distance tip of snout — back end of maxillary 6.3 - 6.8 in length, about 1.5 in head. Origin of dorsal midway or somewhat behind the middle between tip of snout and first rays of caudal. Ventrals inserted before dorsal, midway between origin of anal and root of pectorals. Distance origin of anal — root of caudal about equal to the distance origin of anal — root of pectorals. Anal inserted behind dorsal, about 7 in length, about as long as the distance tip of snout — back end of maxillary. Pectorals about as long as postorbital part of head. Ventrals ⅔ of pectorals, 4 - 5 abdominal spines, the hindermost one remote from the ventrals (Fig. 11). Gillrakers 20 - 23. Scales deciduous, striated. (See Fig. 10i). A silvery lateral band on the sides. A black spot on occiput. Back and caudal powdered with black. Other fins hyaline. Ovarial eggs oval shaped. Longest specimens known 10 cm. (The length at which maturity is reached is unknown to me, as all my specimens were mature).

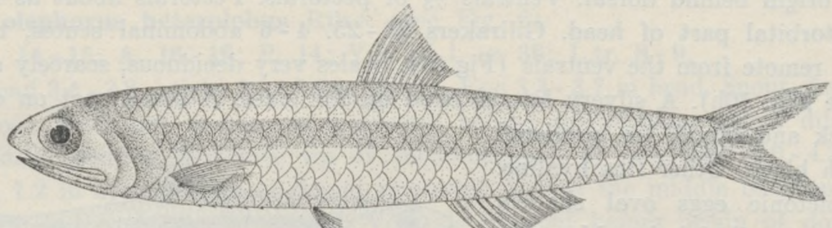

Fig. 8. — *Stolephorus zollingeri.*

Stolephorus zollingeri differs from other species by the truncated maxillary, a feature which it has in common with several Pacific-species. Thus far I got specimens only from Ambon, Menado and from Puger on the southcoast of Java (Indian Ocean). According to the literature it is distributed over the whole Indo-Australian Archipelago.

[1]) According to the bad state of preservation it was not possible for me to count the linea laterals with certainty, but its number is most likely about 38.

9. **Stolephorus celebicus** HARDENBERG [1]). (See Fig. 9).

D. 14 - 15; A. 13 - 14; P. 15; V. 7; L.l. 35 - 36; L.v. 8.

Head 3.4 - 3.7, height 6.0 - 6.7 in length. Eye 4.0 - 4.2 in head. Snout somewhat shorter than eye. Maxillary reaches to mandibulary joint, dilated posteriorly, truncated. Distance tip of snout — backened of maxillary 1.5 - 1.4 in head, 4.5 - 5.0 in length. Origin of dorsal behind the middle between tip of snout and first rays of caudal. Ventrals inserted before dorsal, midmay between origin of anal and suboperculum. Distance origin of anal-root of caudal about one half to three fourth of the pectoral fin shorter as the distance origin of anal — root of pectoral. Anal inserted behind dorsal, 7.4 - 7.5. in length somewhat longer than snout and eye. Pectorals shorter than postorbital part of head. Ventrals about ⅔ of pectorals. No abdominal scutes! Gillrakers 23 - 25. Scales not very deciduous, striated (see Fig. 10j). A silvery lateral band on the sides. A black spot on occiput. Back and caudal powdered with black. Other fins hyaline. Ovarial eggs oval shaped. Longest specimens known 10 cm. (The length at which maturity is reached is unknown to me, as all my specimens were mature).

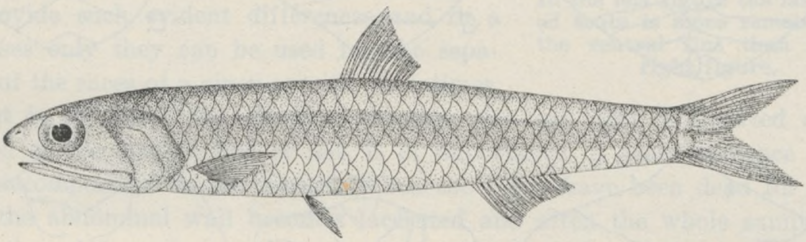

Fig. 9. — *Stolephorus celebicus.*

Stolephorus celebicus is related to *St. zollingeri,* from which it differs chiefly by the finformulae, the longer head, by the fact that the anal fin is situated nearer to the caudal and by the absence of the abdominal scutes.

I got specimens of *St. celebicus* only from Menado thus far, but I suppose that it can be found in the whole eastern half of the Indo-Australian Archipelago.

IV. STATISTICAL DIFFERENCES WITHIN EACH SPECIES.

When comparing the samples of each species from different localities I found, as could be expected, differences of a statistical nature. These differences were most evident in the numbers of the gillrakers, the vertebrae and the keeled abdominal scutes. The differences, if any, between the numbers of rays of the paired or unpaired fins were at any rate too small to be stated when dealing with the sometimes comparatively small samples at my disposal. The statistical results were not sufficiently convincing to draw any conclusions. I have, therefore, omitted in the following pages any record on the finrays.

[1]) Described by me for the first time in Natuurkundig Tijdschrift voor Nederlandsch Indië, Deel XCIII, 1933.

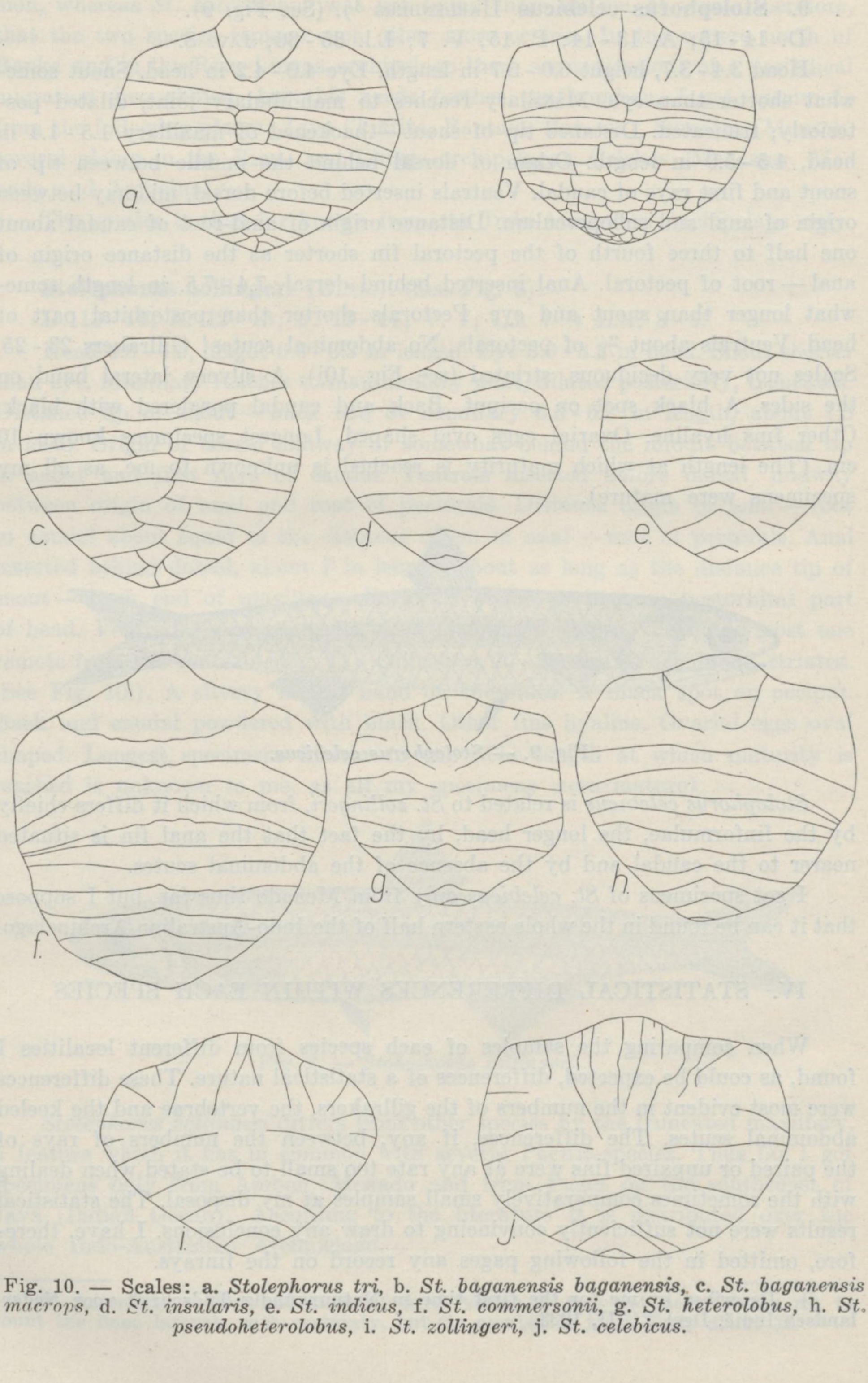

Fig. 10. — Scales: a. *Stolephorus tri*, b. *St. baganensis baganensis*, c. *St. baganensis macrops*, d. *St. insularis*, e. *St. indicus*, f. *St. commersonii*, g. *St. heterolobus*, h. *St. pseudoheterolobus*, i. *St. zollingeri*, j. *St. celebicus*.

Differences in the numbers of gillrakers, counted on the lower branch of the first gillarch, are often very evident and form a good means to separate the different populations. In counting them one has to pay special attention to those quite near the copulae, as these are often very small and may therefore easily be overlooked. Another difficulty is the fact, that, when the sample contains fishes which are not quite fresh (and such is often the case in the tropics), the gillrakers are stuck together by a mucous secretion. The gillrakers are not easily to be counted in that case and when the animals are small it is sometimes impossible as the mucus cannot well be washed out, when it has been some time in formaline or alcohol. Especially *Stolephorus heterolobus* shows this phenomenon and I had even to leave out a few samples as the results were not reliable.

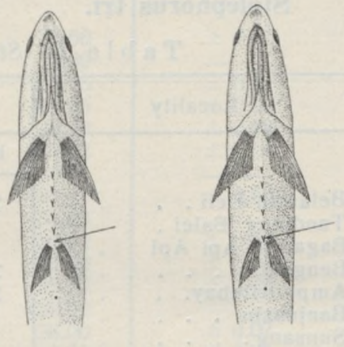

Fig. 11. — The different arrangement of the keeled scutes. In the left figure the last keeled scute is more remote from the ventral fins than in the right figure.

The numbers of keeled abdominal scutes do not provide such evident differences and in a few cases only they can be used for the separation of the races of a given species. Sometimes, but not in all cases, the question, whether the last scute is inserted at the junction of the ventral fins or not, is of importance. A great nuisance is the quick decomposition in the tropics. When the fishes have been dead for a few hours the abdominal wall becomes lacerated and often the whole sample has to be discarded as far as the counting of the keeled scutes concerns. More especially the species with a somewhat rounded abdomen, as for instance *Stolephorus heterolobus, pseudoheterolobus, commersonii* and *indicus* show this phenomenom. The high, flattened, species, as *Stolephorus baganensis, tri* and others show it in a much lesser degree.

Other scales, as for instance those of the linea lateralis cannot be counted and are of no statistical use. They are very deciduous, though again in one species more than in another. Species with very deciduous scales are *Stolephorus heterolobus, pseudoheterolobus, commersonii, indicus* and *insularis.* The other species show this particularity in a much lesser degree, though practically always there are some scales lost and the countings are therefore not reliable.

The numbers of the vertebrae are of great importance when distinguishing the different races and species, quite in accordance with the results of investigations in temperate regions. The differences are as well intra- as interspecific, but do not alwas run parallel with the results from the other characters named above. I counted separately the praecaudal and the caudal vertebrae. In recent litterature the numbers of the vertebrae with or without haemal arch are counted, but doing so was in most cases not possible for me. Many specimens were too small (3 - 4 cm) to distinguish both kinds of vertebrae or at any rate it would have taken too much time. As the first caudal vertebra I took the

first one with a single ventral processus behind the abdominal cavity, which of course is about the same as to distinguish vertebrae with or without haemal arch. Yet the method which I had to use is not quite so safe.

Let us now consider each species apart.

Stolephorus tri.

Table I. *Stolephorus tri.* Praecaudal Vertebrae.

Locality	Vertebrae 18	19	20	N.	Average	Standard error
Belawan Deli	2	2		4	18,50	± 0,25
Tandjung Balei		1		1	19,00	——
Bagan si Api Api		4		4	19,00	± 0,00
Bengkalis	2	17	1	20	18,95	± 0,08
Amphitritebay	2	21	2	25	19,00	± 0.08
Banjuasin		24	1	25	19,04	± 0,04
Sunsang		3		3	19,00	——
Lucipara	2	23		25	18,92	± 0,05
Batavia		1		1	19,00	——
Tjilamaja		4		4	19,00	± 0,00
Cheribon		25		25	19,00	± 0,00
Sawudjadjar	2	9		10	18,90	± 0,09
Tuban		1		1	19,00	——
Grissee		18	2	20	19,10	± 0,06
Kumai		7		7	19,00	± 0,00

Table I deals with the number of praecaudal vertebrae. The most common number is 19 and a few times 18 or 20 may be found. The averages are uniform. Differences cannot be traced.

Table II. *Stolephorus tri.* Caudal Vertebrae.

Locality	Vertebrae 18	19	20	N.	Average	Standard error
Belawan Deli	1	2	1	4	19,00	± 0,35
Tandjung Balei		1		1	19,00	——
Bagan si Api Api	1	3		4	18,75	± 0,21
Bengkalis	1	18	1	20	19,00	± 0,07
Amphitritebay	2	21	2	25	19,00	± 0,08
Banjuasin	3	21	1	25	18,92	± 0,08
Sunsang	1	2		3	18,77	——
Lucipara	2	22	1	25	18,96	± 0,07
Batavia		1		1	19,00	——
Tjilamaja		4		4	19,00	± 0,00
Cheribon	5	20		25	18,80	± 0,08
Sawudjadjar	1	8	1	10	19 00	± 0,13
Tuban		1		1	19,00	——
Grissee	2	18		20	18,90	± 0,06
Kumai		7		7	19,00	± 0,00

In Table II the number of caudal vertebrae is given, ranging from 18 - 20, with the maximum at 19. The averages are very uniform 19.00 or somewhat less. There are no statistical differences.

Table III. *Stolephorus tri.* Total Number of Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	37	38	39			
Belawan Deli	2	2		4	37,50	± 0,25
Tandjung Balei		1		1	38,00	——
Bagan si Api Api . . .	1	3		4	37,75	± 0,21
Bengkalis	2	17	1	20	37,95	± 0,08
Amphitritebay.	2	21	2	25	38,00	± 0,08
Banjuasin	3	21	1	25	37,92	± 0,08
Sunsang	1	2		3	37,77	——
Lucipara.	3	22		25	37,88	± 0,06
Batavia		1		1	38,00	——
Tjilamaja		4		4	38,00	± 0,00
Cheribon.	5	20		25	37,80	± 0,08
Sawudjadjar	1	9		10	37,90	± 0,09
Tuban.		1	1	1	38,00	——
Grissee	1	18		20	38,00	± 0,07
Kumai.		7		7	38,00	± 0,00

The total number of vertebrae, shown in Table III, ranges from 37 - 39, with the maximum at 38. The averages are again very uniform, all 38 or a little less. There are no statistical differences.

Table IV. *Stolephorus tri.* Number of Gillrakers.

Locality	Gillrakers					N.	Average	Standard error
	18	19	20	21	22			
Belawan Deli . .		1	2	1		4	20,00	± 0,35
Tandjung Balei. .				1		1	21,00	——
Bagan si Api Api.			1	3		4	20,75	± 0,21
Bengkalis		5	11	6		20	20,05	± 0,16
Amphitritebay . .		9	13	2		25	19,72	± 0,12
Banjuasin	1	3	11	10		25	20,20	± 0,16
Sunsang			2	1		3	20,33	——
Lucipara	1	11	10	3		25	19,60	± 0,15
Batavia.			1			1	20,00	——
Tjilamaja		1	1	2		4	20,25	± 0,41
Cheribon			8	16	1	25	20,72	± 0,10
Sawudjadjar . . .		1	4	5		10	20,40	± 0,19
Tuban			1			1	20,00	——
Grissee.			10	9	1	20	20,55	± 0,13
Kumai			1	6		7	20,86	± 0,13

Table IV contains the number of gillrakers, ranging between 18 and 22. The Sumatra-samples taken from the different localities between Belawan Deli and Lacipara all have about the same average. Statistical differences are not found. They have all been collected in localities with about the same oecological conditions (viz, in or near a big rivermouth). The Java-samples, taken from different localities of the north-coast of Java between Batavia and Grissee, show averages which are very uniform too. The Java-averages are slightly higher than those of the Sumatra-samples yet statistical differences do not

exist, one case excepted. Between Bengkalis en Tjilamaja a difference of 0.67 ± 0.19 is found.

The only Borneo sample (Kumai) shows the highest average of all. Yet it shows no statistical difference with the Java-samples and with Belawan Deli and Bagan si Api Api. With the other Sumatra-samples real differences can be calculated.

We may conclude therefore from the above that in some cases very small differences can be observed between local groups.

T a b l e. V. *Stolephorus tri.* Number of keeled Scutes.

Locality	Scutes				N.	Average	Standard error
	4	5	6	7			
Belawan Deli			3	1	4	6,25	± 0,21
Tandjong Balei . . .			1		1	6,00	———
Bagan si Api Api .			4		4	6,00	± 0,00
Bengkalis.		2	15	3	20	6,05	± 0,09
Amphitritebay . . .		2	19	4	25	6,08	± 0,09
Banjuasin.		2	14	9	25	6,28	± 0,12
Lucipara		7	14	4	25	5,88	± 0,13
Batavia			1		1	6,00	———
Tjilamaja.			4		4	6,00	± 0,00
Cheribon	2	3	12	8	25	5,96	± 0,17
Sawudjadjar.			8	2	10	6,30	± 0,12
Tuban				1	1	7,00	———
Grissee		3	9	4	16	6,06	± 0,16
Kumai		1	4	2	7	6,14	± 0,24

In table V the number of keeled scutes is given. They range from 4 to 7 with the maximum at 6. The averages vary between 5.88 ± 0.13 (Lucipara) and 6.25 ± 0.21 (Belawan Deli). Statistical differences are not found.

Summarising the facts given above, we can say, that only the table on the gillrakers gives some evidence of the existence of local groups. The differences are very small.

As a curiosity the fact should be mentioned here that in the Lucipara-sample three specimens were found totally lacking the ventral fins [1]).

[1]) The absence of the ventral fins is a phenomenom found in several genera belonging to quite different families. MIJERS and SHAPOVOLOV in the Peking Natural History Bulletin, Vol. 6, discuss the validity of the genera *Channa* and *Ophiocephalus*, the chief difference between them being the absence or presence the ventral fins. They conclude that the two genera are identical as specimens of *Ophiocephalus* may be found without pelvic fins. The same question is considered by S.L. HORA in the Records of the Indian Museum Vol. XXII where he concludes that the *Cobitid* genera *Acanthophthalmus* and *Apua* are identical for the same reasons pointed out above.

The absence of the pelvic fins is noted in several other genera viz. *Barilius*, *Abramis*, *Ameiurus*, and some *Cyprinodont* genera (*Tellia*, *Empetrichthys*). In the case of the *Cyprinodonts* we have some reason to assume that the absence is due to external factors i.c. thermal springs.

I possess a specimen of *Scleropages formosus* without the pelvic fins.

Stolephorus baganensis.

Stolephorus baganensis is a species very common in the big rivermouths of Sumatra. Along the Java-coast it is much rarer, the vicinity of Grissee and Surabaja, where two big rivers empty into the sea, excepted. As may be expected several races exist. In the first place a variety which I have called the *"macrops"* (see description of the species), characterized by the short anal fin, by the somewhat bigger eye and, when alive or quite fresh, by the white, instead of yellow, tail. The other race which is much more common than *macrops* at the fishmarkets can be designated then as *St. baganensis baganensis.* The number of gillrakers, which I first thought to be a good characteristic when distinguishing the two varieties does not hold good as such in all cases, as it varies in different localities.

First I thought there was some reason to distinguish a third variety. The sample Batavia II had one vertebrae more than most other samples. However, in the course of further investigations I found other samples which formed transitions in this respect to the real *baganensis*-specimens. Moreover there are no taxonomic differences. I concluded therefore that the sample Batavia II is only a separate local race of *St. baganensis baganensis.* Only it is curious that in Batavia we find two races. (Batavia I and Batavia II). Batavia II contains immature specimens only and I did not find it in other localities. They are mostly mixed with other species and only once did I see a pure sample.

Stolephorus baganensis baganensis.

Table VI. *Stolyphorus baganensis baganensis.* Praecaudal Vertebrae.

Locality	Vertebrae					N.	Average	Standard error
	17	18	19	20	21			
Labuan Deli I . .			20	5		25	19,20	± 0,08
Labuan Deli II . .		1	21	3		25	19,08	± 0,08
Panei I. . . , . .		1	20	4		25	19,12	± 0,08
Panei II.			17	8		25	19,32	± 0,09
Bagan si Api Api.	1	2	22			25	18,84	± 0,09
Tandjung Balei. .			4			4	19,00	± 0,00
Amphitritebay . .			3	1		4	19,25	± 0,21
Banjuasin I . . .			13	1		14	19,07	± 0,06
Banjuasin I . . .			2			2	19,00	—
Sunsang			19	6		25	19,24	± 0,08
Lucipara		4	20	1		25	18,88	± 0,08
Labuan		1	6			7	18,86	± 0,13
Batavia I		2	18	3		23	19,04	± 0,09
Batavia II			2	21	2	25	20,00	± 0,08
Cheribon		1	21	3		25	19,08	± 0,08
Kendal			5	4		9	19,44	± 0,16
Semarang		1	10	2		13	19,07	± 0,13
Tuban			11	2		13	19,15	± 0,10
Surabaja			24	1		25	19,01	± 0,04
Kumai			25			25	19,00	± 0,00

In table VI the numbers of praecaudal vertebrae are given. They range from 17 - 21, all samples having their maximum at 19. Only the sample Batavia II forms an exception and has its maximum at 20. It is therefore easy to see that this sample, with an average of 20.00 ± 0.08 belongs to a definite race. Of the averages only three are lower than 19, viz. Bagan si Api Api (18.84 ± 0.09), Lucipara (18.88 ± 0.08) and Labuan (18.86 ± 0.13). The remaining samples have no statistical differences and if we compare the above-named three low averages with the other, higher, ones, we can find in most cases no differences either. Only if we compare Bagan with Panei, we see a real statistical difference, in this case 0.48 ± 0.12. If we compare Bagan with another sample there is again no difference.

T a b l e VII. *Stolephorus baganensis baganensis.* Caudal Vertebrae.

Locality	Vertebrae				N.	Average	Standard error
	18	19	20	21			
Labuan Deli I . .	1	14	10		25	19,36	± 0,11
Labuan Deli II . .	1	9	13	2	25	19,64	± 0,13
Panei I.	1	12	12		25	19,44	± 0,11
Panei II.		12	13		25	19,52	± 0,09
Bagan si Api Api .		11	14		25	19,56	± 0,10
Tandjung Balei. .		1	3		4	19,75	± 0,21
Amphitritebay . .	1	2	1		4	19,00	± 0,35
Banjuasin I . . .	1	12	1		14	19,00	± 0,10
Banjuasin II . . .		2			2	19,00	——
Sunsang	1	6	18		25	19,76	± 0,11
Lucipara	2		3		25	19,04	± 0,09
Labuan		6	1		7	19,14	± 0,13
Batavia I. . . .		14	9		23	19,39	± 0,12
Batavia II. . . .		14	10	1	25	19,48	± 0,11
Cheribon	1	13	11		25	19,40	± 0,10
Kendal		7	2		9	19,22	± 0,13
Semarang		10	3		13	19,23	± 0,11
Tuban	1	9	4		13	19,23	± 0,15
Surabaja		24	1		25	19,04	± 0,04
Kumai		21	4		25	19,16	± 0,07

In table VII the number of caudal vertebrae is given. As was the case with praecaudal vertebrae the limits are very wide, lying between 18 and 21, with the maximum at 19 and 20. The averages range between 19.76 ± 0.11. (Sunsang) and 19.00 ± 0.10 (Banjuasin I). The difference between these two samples is real. If we compare the other samples with the above named and

with other we find in a few cases some difference, but mostly not. At any rate is never very evident.

Table VIII. *Stolephorus baganensis baganensis.* Total Number of Vertebrae.

Locality	Vertebrae 37	38	39	40	41	N.	Average	Standard error
Labuan Deli I . .		11	14			25	38,56	± 0,10
Labuan Deli II . .	1	7	15	2		25	38,72	± 0,13
Panei I.	1	9	15			25	38,56	± 0,11
Panei II.		5	19	1		25	38,84	± 0,09
Bagan si Api Api.	1	13	11			25	38,40	± 0,11
Tandjung Balei. .		1	3			4	38,75	± 0,21
Amphitritebay . .		3	1			4	38,25	± 0,21
Banjuasin I . . .	1	11	2			14	38,07	± 0,12
Banjuasin II . . .		2				2	38,00	——
Sunsang		3	19	3		25	39,00	± 0,09
Lucipara	4	21				25	37,84	± 0,07
Labuan		7				7	38,00	± 0,00
Batavia I. . . .		13	10			23	38,43	± 0,08
Batavia II. . . .			14	10	1	25	39,48	± 0,11
Cheribon	1	10	14			25	38,52	± 0,11
Kendal		3	6			9	38,67	± 0,15
Semarang		11	4			13	38,30	± 0,12
Tuban	1	6	6			13	38,38	± 0,17
Surabaja		14	11			25	38,44	± 0,10
Kumai		21	4			25	38,16	± 0,07

Table VIII deals with the total number of vertebrae, which varies from 37 - 41 with the maximum at 38 and 39. The sample Batavia II has in accordance with what has been found in Table VI, the highest average. The other averages range between 39.00 ± 0.09 (Sunsang) and 38.00 ± 0.00 (Labuan), which gives a real difference. The Sunsang sample is also different from the sample Banjuasin I. Both localities are only a few miles apart in the estuary of the Musi. We are dealing here probably with two different races.

The other Sumatra-samples (Labuan Deli-Lucipara) show statistical differences with the samples Sunsang and Banjuasin, others not. Evidently we have here again gliding differences.

The Java samples (Batavia II excepted) have no differences between each other and show in some cases differences with Sumatra-samples and in others not. The averages are in general somewhat lower, but it cannot be settled here, whether this is due to real differences or to chance only. The Kumai-average (Borneo) is rather low, but again the differences with other samples are too small as to allow us to separate this sample, in a mathematical way, from the others.

Table IX. *Stolephorus baganensis baganensis.* Number of Gillrakers.

Locality	Gillrakers											N.	Average	Standard error
	19	20	21	22	23	24	25	26	27	28	29			
Labuan Deli I . .			7	12	6							25	21,96	± 0,14
Labuan Deli II . .			3	9	13							25	22,40	± 0,14
Panei I				7	4	14						25	23,28	± 0,17
Panei II		1	7	15	2							25	21,72	± 0,13
Bagan si Api-Api .				7	12	5	1					25	23,00	± 0,17
Tandjung Balei . .				3	1							4	22,25	± 0,21
Amphitritebay . .				1	3							4	22,75	± 0,21
Banjuasin I . . .		5	9									14	20,64	± 0,12
Banjuasin II . . .						1		1				2	25,00	——
Sunsang						12	13					25	24,52	± 0,10
Lucipara	10	12	3									25	19,72	± 0,13
Labuan								1	3	3		7	27,28	± 0,26
Batavia I						10	9	4				23	24,74	± 0,15
Batavia II . . .							13	12				25	25,48	± 0,10
Cheribon						7	14	4				25	24,80	± 0,15
Kendal						1	7	1				9	25,00	± 0,15
Semarang						4	7	2				13	24,85	± 0,18
Tuban							3	5	1	4		13	26,46	± 0,32
Surabaja							7	6	8	4		25	26,36	± 0,21
Kumai							2	1	11	6	5	25	27,44	± 0,22

The numbers of gillrakers are given in Table IX. They have, as we have found for other species too, wide limits, ranging from 19 - 29. A single look at the table reveals the fact, that the Sumatra specimens have in general fewer gillrakers than the Java and Borneo ones. This confirms the supposition made above, when dealing with the total number of vertebrae, that the Java specimens form a group apart and, the Sumatra-specimens another group. Only the samples Sunsang and Banjuasin II have averages like the Java specimens.

We will consider first the Sumatra-sample. In the first place it is confirmed here again, what has been found already above, that the samples Sunsang and Banjuasin I belong to different races. Banjuasin II belongs probably to the Sunsang race. The above-named samples were collected in the Musi-estuary at the northern entrance of Bangka-Strait. The Lucipara-sample from the southern entrance of Bangka-Strait forms also a group apart, differing from Banjuasin, Sunsang and all others Sumatra-samples. It has the lowest average of all. The samples Amphitrite-bay, Tandjung Balei and Bagan si Api Api have no statistical differences between them and seem to belong to one group. Yet this is not quite certain. Tandjung Balei has the lowest average and we will see below that the number of keeled scutes in this sample is also somewhat different from the others. Tandjung Balei specimens seem to belong to a separate group therefore. If we consider the natural conditions in which

the above named samples live, we will find this opinion confirmed. The Amphitrite-bay and Bagan si Api Api-samples have been collected in estuaries with rather muddly and more or less brackish water. The Tandjong Balei-sample has been collected in water which has a nearly constant and higher salinity.

The sample Panei II is clearly different from other samples and therefore belongs also to a separate group. The sample Panei I, with an average of 23.28 ± 0.17, is statistically not different from Bagan si Api Api with an average of 23.00 ± 0.17. In the mouth of the Deli river we meet again two different samples (Labuan Deli I and II), belonging to two different races. The Labuan-Deli II specimens have a pigmented nose and those belonging to Labuan Deli I not. Thus it can be seen at once to which race each single specimen belongs. Labuan Deli II forms a separate group, with its average of 22.40 ± 0.14, which is not so certain for the sample Labuan-Deli I. This latter sample has statistically about the same average as the sample Panei II (21.96 ± 0.14 and 21.72 ± 0.13). From what has been said above it follows, that almost every part of the Sumatra-coast has its own local group. As all samples have been collected in the estuaries of the big rivers (Tandjung Balei excepted) we may say that each rivermouth has its own group of specimens and sometimes even two. Two e.g. are found in the Deli-river (Labuan Deli I and II), the Panei-river (Panei I and II) and the Musi-river (Banjuasin and Sunsang). All these groups belong to *St. baganensis baganensis*. In the mouth of the Rokan (Bagan si Api Api) and the Indragiri (Amphitritebay) we find only one group belonging to the *baganensis* variety, but here are also found specimens belonging to the *macrops* variety, as we will see below.

Let us consider now the Java-samples. The Labuan sample with its average of 27.28 ± 0.16 belongs evidently to a separate group. The two Batavia-samples are mutually different. That sample Batavia II belongs to a separate race has been pointed out already, when dealing with the vertebrae (see above). That conclusion is confirmed here by the number of gillrakers.

The sample Batavia I with its average of 24.74 ± 0.15, is not different from the samples Cheribon (24.80 ± 0.15), Kendal (25.00 ± 0.15) and Semarang (24.85 ± 0.18). In the same way the samples Tuban and Surabaja belong together, with averages of 26.46 ± 0.32 and 26.36 ± 0.21. The samples Batavia I, Cheribon, Kendal and Semarang belong to one group, with a gillrakers-number of 24.25 or 26 and the samples Tuban and Surabaja to another group with a gillrakernumber of 25, 26, 27 or 28.

It is a curious fact that near Surabaja in the vicinity of two river-mouths, viz. those of the Solo and the Brantas, we find again two races of *St. baganensis*, one of the *baganensis* group, given above, and one of the *macrops* group (the Grissee-sample, see below).

I posses only one sample from Borneo viz. from Kumai situated at the mouth of the Kumai-river. Statistically the average is the same as the average of the Labuan-sample. Yet I suppose this is only a coincidence, as the finding-

places are several hundred miles apart from each other and the biological conditions are not the same. The Kumai specimens live in a rivermouth and the Labuan specimens in the more oceanic waters of Sunda Strait. In the mouth of the Kumai again two races occur, one of the *baganensis* and the other of the *macrops*-group. The latter race has not actually been found yet, but the eggs occur in the plancton. (See DELSMAN Treubia Vol. XIII).

Table X. *Stolephorus baganensis baganensis*. Number of keeled scutes.

Locality	Scutes					N.	Average	Standard error
	4	5	6	7	8			
Labuan Deli I . .	2	5	12	6	1	25	6,04	± 0,10
Labuan Deli II . .			13	12		25	6,48	± 0,10
Panei I			17	8		25	6,32	± 0,06
Panei II.		5	17	3		25	5,92	± 0,11
Bagan si Api Api.		1	12	12		25	6,44	± 0,11
Tandjung Balei. .		4				4	5,00	± 0,00
Amphitritebay . .			2	2		4	6,50	± 0,25
Sunsang		1	17	7		25	6,16	± 0,13
Lucipara			18	5		25	6,12	± 0,10
Labuan			3	4		7	6,42	± 0,18
Batavia I			15	8		23	6,34	± 0.07
Batavia II			17	8		25	6,32	± 0,09
Cheribon			8	17		25	6,68	± 0,09
Kendal			1	8		9	6,89	± 0,10
Semarang			7	6		13	6,46	± 0,13
Tuban			4	9		13	6,69	± 0,12
Surabaja		2	13	10		25	6,32	± 0,12
Kumai		2	15	6	2	25	6,32	± 0,14

Table X gives the number of keeled scutes, ranging from 4 to 8, with the maximum at 6 and 7. This table, will not teach us much that is new, as the table of the gillrakers has already given us a clear view on the existence of many local groups. It confirms only the facts found in the foregoing table.

If we consider first the Sumatra-samples we see that Lucipara and Sunsang have the same averages. The Tandjung Balei-sample is quite different from the Amphitritebay and the Bagan sample, a fact already stated above. The samples Amphitritebay and Bagan show no differences. Panei II is clearly different from Panei I and Bagan si Api Api. Labuan Deli I and II are clearly different. The samples Panei II and Labuan Deli I show no differences here, a fact already pointed out above.

Considering the Java-samples we see, that the Labuan sample, with its average of 6.42 ± 0.18, is not different from Batavia I, but the averages for

the gillrakers have shown us already that they belong to two different groups. Batavia I has about the same average as Semarang. Statistical differences cannot be traced. The averages of Kendal and Cheribon are somewhat higher and real differences with Semarang and Batavia exist. Statistically we should have two groups here, one occurring in Kendal and Cheribon and the other in Batavia and Semarang. Biologically we should not expect this as Kendal and Cheribon are situated between Batavia and Semarang. It may be, however, that each group is found along the whole coast. Tuban has an average of 6.69 $\pm$ 0.12 and Surabaja 6.32 $\pm$ 0.12, the difference being 0.37 $\pm$ 0.17, statistically not sufficient. The Kumai-sample presents no occasion for further remarks.

Stolephorus baganensis macrops.

Table XI. *Stolephorus baganensis macrops.* Praecaudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	18	19	20			
Bagan si Api Api . . .		5		5	19,00	± 0,00
Bengkalis		25		25	19,00	± 0,00
Amphitritebay	1	23	1	25	19,00	± 0,05
Grissee		3	1	4	19,25	± 0,21

Table XI gives the number of praecaudal vertebrae, ranging from 18 - 20, with the maximum at 19. Statistical differences are not found.

Table XII. *Stolephorus baganensis macrops.* Caudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	18	19	20			
Bagan si Api Api . . .	1	4		5	18,80	± 0,17
Bengkalis	3	22		25	18,88	± 0,06
Amphitritebay	2	22	1	25	18,96	± 0,07
Grissee	1	3		4	18,75	± 0,21

In Table XII the numbers of caudal vertebrae are given. They range from 18 - 20, with the maximum at 29. As in the foregoing table statistical differences do not exist.

Table XIII. *Stolephorus baganensis macrops*. Total Number of Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	37	38	39			
Bagan si Api Api . . .	1	4		5	37,80	± 0,17
Bengkalis	3	22		25	37,88	± 0,06
Amphitritebay . . .	3	20	2	25	37,96	± 0,09
Grissee		4		4	38,00	± 0,00

Table XIII deals with the total number of vertebrae ranging from 37 - 39, with the maximum at 38. Statistical differences cannot be traced.

Table XIV. *Stolephorus baganensis macrops*. Number of Gillrakers.

Locality	Gillrakers				N.	Average	Standard error
	19	20	21	22			
Bagan si Api Api . .	1	4			5	19,80	± 0,17
Bengkalis	6	16	3		25	19,88	± 0,11
Amphitritebay	9	12	3	1	25	19,84	± 0,15
Grissee		2	2		4	20,50	± 0,25

Table XIV shows the number of gillrakers, ranging from 19 - 22, with the maximum at 20. The three Sumatra-samples (Bagan si Api Api, Bengkalis and Amphitritebay) have about the same average, with no statistical differences between them. Only the small Java-sample (Grissee), has a higher average, but the statistical difference is not sufficient to separate it from the rest.

Table XV. *Stolephorus baganensis macrops*. Number of keeled Scutes.

Locality	Scutes			N.	Average	Standard error
	5	6	7			
Bagan si Api Api . . .	2	3		5	5,60	± 0,21
Bengkalis	5	18	2	25	5,88	± 0,10
Amphitritebay	2	20	3	25	6,04	± 0,09
Grissee		1	3	4	6,75	± 0,21

The number of keeled abdominal scutes given in Table XV ranges from 5 - 7, with the maximum at 6. Once again we can find no statistical differences, between the samples Bagan, Amphitritebay and Bengkalis. The average of the Grissee-sample is much higher and shows a real difference with the three

others. The differences found in the gillrakers-table, though not sufficient, tend also in this direction.

Summarising the facts found above, we can say, that *St. baganensis baganensis* shows a tendency to split up into many smaller local races and groups. This is not so obvious with *St. baganensis macrops* of which perhaps the Sumatra-samples belong to one group, the Java-sample to another group.

Within the *baganensis* variety we see that the Sumatra-samples are almost all related to each other according to the low numbers of gillrakers and the Java-samples belong together because of the high numbers of gillrakers.

Especially the number of gillrakers gives us much information about the existence of local groups. The number of keeled scutes do so only in a much lesser degree. We have found the same facts above with the other species. Only in some cases we see differences between the numbers of vertebrae. The difference is very obvious in the sample Batavia II.

In many rivermouths we may find two different groups of the *St. baganensis,* either belonging to the *baganensis* and the *macrops* variety or each of the two groups may belong to the *baganensis* variety.

Stolephorus insularis.

Stolephorus insularis can be subdivided into smaller groups, as is the case with *Stolephorus indicus.* We can distinguish four separate groups here:

1e A group with mostly $20 + 19 = 39$ vertebrae. I propose to call this group *Stolephorus insularis insularis,* as it is by far the most common one.

2e A group with mostly $21 + 20 = 41$ vertebrae. Further on I will call this group *Stolephorus insularis bataviensis,* as it was from a sample of Batavia, that I first learned to distinguish it.

3e A group with, mostly $20 + 20 = 40$ vertebrae, and with about 20 gillrakers. I will call this group *Stolephorus insularis baweanensis,* as I got my first sample from the island Bawean in the Java-Sea. All specimens have a rather pigmented nose and back.

4e A group with mostly $20 + 20 = 40$ vertebrae and with a number of gillrakers much more than 20. I will give it the name of *Stolephorus insularis oceanicus,* as I learned to distinguish it for the first time from a sample from of the south-coast of Java. It can be distinguished from the *baweanensis* group at a glance, as it is much less pigmented.

We should expect here the same phenomenom as with *Stolephorus indicus,* viz. that the specimens belonging to a group with a higher number of vertebrae are much bigger when ripe than the specimens with a lower number of vertebrae. Yet this is not the case, at least not with the first two groups. *Insularis* as well as *bataviensis* are ripe at a length of 6 - 7 cm (see description of the species). Perhaps *baweanensis* is bigger, though the number of vertebrae is

intermediate. As a fact specimens of *baweanensis* are very long, much longer than the specimens of *bataviensis* and *insularis* in my posession. As I have no immature specimens of *baweanensis* the question at which length they are ripe cannot be settled yet. About the *oceanicus* group nothing can be said in this respect, as all my specimens are immature.

Stolephorus insularis insularis.

Table XVI. *Stolephorus insularis insularis.* Praecaudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	19	20	21			
Belawan Deli		1		1	20,00	——
Tandjung Balei	3	6		9	19,67	± 0,15
Monong		1	1	2	20,50	——
Sunsang I		16	2	18	20,11	± 0,07
Sunsang II		2		2	20,00	——
Labuan		9		9	20,00	± 0,00
St. Nicolaaspoint . . .		3		3	20,00	——
Bantam		21	4	25	20,16	± 0,07
Batavia	2	22	1	25	19,96	± 0,06
Tjiparage		1		1	20,00	——
Tjilamaja		11	1	12	20,08	± 0,03
Cheribon.	4	21		25	19,84	± 0,07
Sawudjadjar	1	24		25	19,96	± 0,04
Kendal		2		2	20,00	——
Semarang	1			1	19,00	——
Tuban	1	9		10	19,90	± 0,09
Pasoeroean	1	24		25	19,96	± 0,04
Puger		2		2	20,00	——
Kumai.	13	12		25	19,48	± 0,09
Macassar I.		17	1	18	20,05	± 0,05
Macassar II.		1		1	20,00	——

In Table XVI the number of praecaudal vertebrae is given. Most specimens have 20 vertebrae and only an occasional one 19 or 21. The averages range between 19.48 ± 0.09 (Kumai) and 20.16 ± 0.07 (Bantam), but most of them are about 20, and only Kumai (19.48 ± 0.09) and Tandjung Balei (19.67 ± 0.15) make an exception. The Kumai sample shows no statistical difference with Tandjung Balei but a real one with the other samples. The Kumai-sample apparently forms a separate group, with which the small Tandjong Balei-sample shows a close agreement, though statistically the latter shows no difference with the remaining samples.

Table XVII. *Stolephorus insularis insularis.* Caudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	18	19	20			
Belawan Deli		1		1	19,00	—
Tandjung Balei		4	5	9	19,56	± 0,16
Monong	2			2	18,00	—
Sunsang I	1	17		18	18,95	± 0,05
Sunsang II		2		2	19,00	—
Labuan		8	1	9	19,11	± 0,10
St. Nicolaaspoint		3		3	19,00	—
Bantam		25		25	19,00	± 0,00
Batavia	2	21	2	25	19,00	± 0,08
Tjiparage		1		1	19,00	—
Tjilamaja		12		12	19,00	± 0,00
Cheribon		19	6	25	19,24	± 0,08
Sawudjadjar	1	22	2	25	19,04	± 0,06
Kendal		2		2	19,00	—
Semarang			1	1	20,00	—
Tuban		10		10	19,00	± 0,00
Pasuruan	3	20	2	25	18,96	± 0,09
Puger		2		2	19,00	—
Kumai		12	13	25	19,52	± 0,10
Macassar I	1	15	2	18	19,05	± 0,09
Macassar II		1		1	19,00	

Table XVII shows the number of caudal vertebrae. There are mostly 19 of them per animal and sometimes 18 or 20. The averages are all about 19.00. Tandjung Balei and Kumai offer an exception again. Their averages are much higher, 19.56 ± 0.16 and 19.52 ± 0.10 respectively, thus confirming the conclusions drawn from Table XXVII. The Cheribon sample is also somewhat higher e.g. 19.24 ± 0.08. Yet the differences between these and other samples are not sufficient to allow of drawing conclusions.

Table XVIII. *Stolephorus insularis insularis.* Total Number of Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	38	39	40			
Belawan Deli		1		1	39,00	—
Tandjung Balei		7	2	9	39,22	± 0,13
Monong	1	1		2	38,50	—
Sunsang I		17	1	18	39,05	± 0,05
Sunsang II		2		2	39,00	—
Labuan		8	1	9	39,11	± 0,10
St. Nicolaaspoint		3		3	39,00	
Bantam		21	4	25	39,16	± 0,07
Batavia	2	23	1	25	38,96	± 0,06
Tjiparage		1		1	39,00	
Tjilamaja		11	1	12	39,08	± 0,03
Cheribon		23	2	25	39,08	± 0,05
Sawudjadjar	1	23	1	25	39,00	± 0,05
Kendal		2		2	39,00	—
Semarang		1		1	39,00	—
Tuban	1	9		10	38,90	± 0,09
Pasuruan	3	21	1	25	38,92	± 0,07
Puger		2		2	39,00	
Kumai	1	23	1	25	39,00	± 0,05
Macassar I	1	14	3	18	39,11	± 0,10
Macassar II		1		1	39,00	—

Table XVIII deals with the total number of vertebrae, which range between 38 and 40, with the maximum at 19. The averages are very uniform, about 39. Statistical differences cannot be found. The lower averages of the Kumai and Tandjung Balei samples for the praecaudal vertebrae are compensated by the higher averages of the caudal vertebrae, the anus having moved forward slightly as is often the case with rivermouth-species or races.

Table XIX. *Stolephorus insularis insularis.* Number of Gillrakers.

Locality	Gillrakers										N.	Average	Standard error
	19	20	21	22	23	24	25	26	27	28			
Belawan Deli . .		1									1	20,00	—
Tandjung Balei. .							4	4	1		9	25,67	± 0,22
Monong	1	1									2	19,50	—
Sunsang I. . . .	3	11	4								18	20,05	± 0,14
Sunsang II. . . .								2			2	26,00	—
Labuan . . , . .	3	5	2								9	19,89	± 0,10
St. Nicolaaspoint .	1	2									3	19,67	—
Bantam.	2	18	5								25	20,12	± 0,10
Batavia.	12	12	1								25	19,56	± 0,14
Tjiparage		1									1	20,00	—
Tjilamaja	5	7									12	19,59	± 0,14
Cheribon	2	13	8	2							25	20,40	± 0,15
Sawudjadjar . . .	11	14									25	19,56	± 0,10
Kendal . , . . .					1	1					2	23,50	—
Semarang		1									1	20,00	—
Tuban	4	6									10	19,60	± 0,15
Pasuruan	12	12	1								25	19,56	± 0,10
Puger		1	1								2	20,50	—
Kumai								5	13	7	25	27,08	± 0,14
Macassar I . . .			6	11	1						18	21,73	± 0,13
Macassar II . . .										1	1	28,00	—

The number of the gillrakers, given in Table XIX, is not so uniform as was the case with the vertebrae. It ranges from 19 - 28 and the most common numbers are 19, 20 or 21. A look at the table shows us at once that the Kumai and Tandjung Balei samples are very different from the rest, a fact evident already from the tables of the vertebrae. The table shows that there is also a real mutual difference between them so that it seems that the insularis from the Kumai- and the Asahanmouth are neither quite alike.

Perhaps the sample Sunsang II belongs also to the Tandjong Balei group, as the oecological conditions are the same (rivermouths!) and the two stations are situated both on the eastcoast of Sumatra. The sample Macassar II statistically seems to belong to the same group as the Kumai sample but I do not think this probable. Apart from the fact that the Macassar II sample, containing one specimen only, is too small to draw reliable conclusions, the two finding-

places are several hundred miles remote from each other and the oecological conditions are not the same. Kumai is situated in the mouth of a big river and Macassar on a reeffringed coast. The sample Macassar I is certainly different from Macassar II sample and the latter is different from all other samples too. Statistically we have here again a separate group.

About the Kendal sample, though small, we can also say with some probability, that statistically it belongs to a separate group.

The averages of the remaining samples show small differences, but in view of the limited quantity of our material and the smallness of the differences we will refrain from making further subdivisions.

Table XX. *Stolephorus insularis insularis.* Number of keeled Scutes.

Locality	Scutes					No.	Average	Standard error
	3	4	5	6	7			
Belawan Deli . .				1		1	6,00	——
Tandjung Balei. .			8	1		9	5,11	± 0,10
Monong				2		2	6,00	——
Sunsang I. . . .			3	14	1	18	5,89	± 0,10
Sunsang II. . . .				2		2	6,00	——
Labuan			2	7		9	5,78	± 0,13
St. Nicolaaspoint .				2	1	3	6,33	——
Bantam.				25		25	6,00	± 0,00
Batavia.			14	11		25	5,44	± 0,15
Tjiparage . , . .				1		1	6,00	——
Tjilamaja		1	11			12	4,92	± 0,03
Cheribon			1	22	2	25	6,04	± 0,04
Sawudjadjar . . .			2	21	2	25	6,00	± 0,08
Kendal	2					2	3,00	——
Semarang		1				1	4,00	——
Tuban				6	1	10	6,10	± 0,09
Puger		2				2	4,00	——
Kumai		5	20			25	4,80	± 0,08
Macassar I . . .				10		10	6,00	± 0,00
Macassar II . . .				1		1	6,00	——

The number of abdominal, keeled scutes (Table XX) ranges from 3 - 7. The Kendal sample has the lowest numbers, which is in accordance with what we found for the gillrakers. We have seen that the Kumai and Tandjung-Balei samples are mutually different as regards the numbers of vertebrae and gillrakers. As regards the keeled scutes the difference is only small.

Still less is this the case with the samples Sunsang II and Macassar II.

The sample Macassar I has an average of 6.00 ± 0.00, not deviating from most other samples.

Summarising the conclusions drawn from the above tables we can say that *Stolephorus insularis insularis* can be divided into a few smaller groups.

The tables on the vertebrae as well as on the gill-rakers show, that the Kumai as well as the Tandjung-Balei samples each are different from the rest having the anus situated slightly more forward (½ vertebrae) and the number of gill-rakers exceptionally high. This is confirmed by the gill-rakers-table.

The gillrakers-table indicates that the samples Macassar I and Kendal also take a somewhat separate position. The remaining samples show small differences of less importance.

Stolephorus insularis bataviensis.

Table XXI. *Stolephorus insularis bataviensis.* Praecaudal Vertebrae.

Locality	Vertebrae		N.	Average	Standard error
	20	21			
Tjarita	1	24	25	20,96	± 0,04
Batavia	4	21	25	20,84	± 0,07
Tjiparage		2	2	21,00	———
Muara Tjimara	5	10	15	20,77	± 0,12
Cheribon.	2	8	10	20,80	± 0,12
Semarang	2	2	4	20,50	± 0,25
Kelampis		2	2	21,00	———
Singapore		1	1	21,00	———

The number of praecaudal vertebrae, shown in Table XXI, is mostly 21 and sometimes 20. The averages are very uniform and give no evidence regarding the existence of separate races.

Table XXII. *Stolephorus insularis bataviensis.* Caudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	19	20	21			
Tjarita	1	23	1	25	20,00	± 0,05
Batavia	1	19	5	25	20,16	± 0,09
Tjiparage		2		2	20,00	———
Muara Tjimara		3	13	15	20,20	± 0,10
Cheribon.		8	2	10	20,20	± 0,12
Semarang	1	2	1	4	20,00	± 0,35
Kelampis.		2		2	20,00	———
Singapore		1		1	20,00	———

Stolephorus insularis bataviensis has mostly 20 caudal vertebrae and sometimes 21 or 19 as is shown in Table XXII. The averages are again very uniform.

Table XXIII. *Stolephorus insularis bataviensis.* Total Number of Vertebrae.

Loeality	Vertebrae 40	Vertebrae 41	N.	Average	Standard error
Tjarita	1	24	25	40,96	± 0,04
Batavia	1	24	25	40,96	± 0,04
Tjiparage		2	2	41,00	———
Muara Tjimara	2	13	15	40,87	± 0,09
Cheribon.		10	10	41,00	± 0,00
Semarang	2	2	4	40,50	± 0,25
Kelampis		2	2	41,00	———
Singapore		1	1	41,00	———

In table XXIII the total numbers of vertebrae are given. Most specimens have 41 and only some 40. The averages are very uniform. There are no indications of the existence of local races.

Table XXIV. *Stolephorus insularis bataviensis.* Number of Gillrakers.

Locality	Gillrakers 19	20	21	22	23	24	N.	Average	Standard error
Tjarita				8	12	5	25	22,88	± 0,14
Batavia	3	13	9				25	20,24	± 0,13
Tjiparage		2					2	20,00	———
Cheribon.		3	7				10	20,70	± 0,14
Semarang		3	1				4	20,25	± 0,21
Kelampis		1	1				2	20,50	———
Singapore			1				1	21,—	———

In table XXIV the number of gillrakers is dealt with. It ranges between 19 and 24. We see at once that the Tjarita-sample is very different from the other ones, which show no differences. The Tjarita-sample seems to belong, therefore to a separate group.

Table XXV. *Stolephorus insularis bataviensis.* Number of keeled Scutes.

Locality	Scutes 5	6	7	N.	Average	Standard error
Tjarita	6	18	1	25	5,80	± 0,09
Batavia	2	22	1	25	5,96	± 0,07
Tjiparage		1	1	2	6,50	———
Cheribon.		8	2	10	6,20	± 0,12

Table XXV gives the number of keeled scutes, ranging from 5 - 7. Perhaps Cheribon is somewhat different from the rest.

Summarising the facts given above, we have to conclude, that *Stolephorus insularis bataviensis* is not so split up into smaller units as was found to be the case with *Stolephorus insularis insularis.* Only the Tjarita-sample is clearly different from the rest by the high number of gillrakers.

Stolephorus insularis baweanensis.

Table XXVI. *Stolephorus insularis baweanensis.* Praecaudal Vertebrae.

Locality	Vertebrae 20	Vertebrae 21	N.	Average	Standard error
Batavia	1		1	20,00	—
Bawean	23	2	25	20,08	± 0,05
Kangean	14	1	15	20,06	± 0,06
Tjilatjap	24	1	25	20,04	± 0,04
Wijnkoopsbay	25		25	20,00	± 0,00
Menado	5		5	20,00	± 0,00

In Table XXVI we see, that most specimens have 20, and only very few have 21 praecaudal vertebrae. The averages are very uniform.

Table XXVII. *Stolephorus insularis baweanensis.* Caudal Vertebrae.

Locality	Vertebrae 19	Vertebrae 20	Vertebrae 21	N.	Average	Standard error
Batavia		1		1	20,00	—
Bawean	4	21		25	19,84	± 0,07
Kangean	1	14		15	19,97	± 0,06
Tjilatjap	2	20	3	25	20,04	± 0,09
Wijnkoopsbay		24	1	25	20,04	± 0,03
Menado	2	2	1	5	19,80	± 0,17

Table XXVII deals with the number of caudal vertebrae. Mostly 20 caudal vertebrae are counted and sometimes 19 or 21. The averages are again very uniform.

Table XXVIII. *Stolephorus insularis baweanensis.*
Total Number of Vertebrae.

Locality	Vertebrae 39	Vertebrae 40	Vertebrae 41	N.	Average	Standard error
Batavia		1		1	40,00	
Bawean	2	23		25	39,92	± 0,05
Kangean		15		15	40,00	± 0,00
Tjilatjap	1	21	3	25	40,08	± 0,08
Wijnkoopsbay		24	1	25	40,04	± 0,03
Menado	1	4		5	39,80	± 0,17

In table XXVIII we see the total number of vertebrae. Most animals have 40 and a few ones 41 or 39. The averages are very uniform. No racial differences can be found.

Table XXIX. *Stolephorus insularis baweanensis.* Number of Gillrakers.

Locality	Gillrakers					N.	Average	Standard error
	18	19	20	21	22			
Batavia			1			1	20,00	——
Bawean.	1	6	17	1		25	19,72	± 0,12
Kangean		4	10	1		15	19,80	± 0,12
Tjilatjap			7	17	1	25	20,76	± 0,10
Wijnkoopsbay . .		2	17	6		25	20,16	± 0,07
Menado.		2	2	1		5	19,80	± 0,33

The number of gillrakers given in Table XXIX ranges between 18 and 22. We see plainly real differences between the averages.

The Bawean and Kangean-samples are very much alike. Bawean and Kangean are islands in the eastern part of the Javasea about 170 miles apart and the natural conditions are about the same. Most probably we have to do here with one single group. The sample from Tjilatjap on the south-coast of Java has the highest average and is very different from the above named samples. The difference between Tjilatjap and the Wijnkoopsbay, equally on the south-coast of Java is 0.60 ± 0.12 and is therefore statistically a real one. On the other hand the Wijnkoopsbay-sample shows no statistical difference from the Kangean-sample. It may be that they will be found different when using much bigger samples as the localities are very far apart. The Menado-sample has the same average as the Bawean and Kangean sample.

Table XXX. *Stolephorus insularis baweanensis.* Number of keeled Scutes.

Locality	Scutes				N.	Average	Standard error
	3	4	5	6			
Batavia			1		2	5,00	——
Kangean		3	6	6	15	5,20	± 0,19
Tjilatjap		3	7	15	25	5,78	± 0,14
Wijnkoopsbay	2	2	8	13	25	5,28	± 0,18

Table XXX shows the number of keeled scutes, which ranges between 3 and 6. This may even be the case in samples from one locality (Wijnkoopsbay). The averages show no statistical differences.

Summarising the facts found above, we can say that in *St. insularis baweanensis* the gillrakers only are of importance for the separation of local groups. The samples from Bawean and Kangean form a single group in which

also the one from the Wijnkoopsbay may be included. This is not the case with the Tjilatjap sample. The Menado-sample does not deviate notably from the Bawean-Kangean-group either.

Stolephorus insularis oceanicus.

Table XXXI. *Stolephorus insularis oceanicus.* Praecaudal Vertebrae.

Locality	Vertebrae 19	Vertebrae 20	N.	Average	Standard error
Batavia		7	7	20,00	± 0,00
Kangean	1		1	19,00	——
Tjilatjap 1	1	24	25	19,96	± 0,03
Tjilatjap 2		13	13	20,00	± 0,00

In Table XXXI the number of praecaudal vertebrae is given. Most specimens have 20 and only occasionally 19 praecaudal vertebrae are found. There is no difference between the averages.

Table XXXII. *Stolephorus insularis oceanicus.* Caudal Vertebrae.

Locality	Vertebrae 19	Vertebrae 20	N.	Average	Standard error
Batavia	1	6	7	19,86	± 0,13
Kangean	1		2	19,00	——
Tjilatjap 1		25	25	20,00	± 0,00
Tjilatjap 2		13	13	20,00	± 0,00

In Table XXXII, which gives the numbers of caudal vertebrae, we see that most specimens have 20 and some 19. The averages are again very uniform.

Table XXXIII. *Stolephoris insularis oceanicus.* Total Number of Vertebrae.

Locality	Vertebrae 39	Vertebrae 40	N.	Average	Standard error
Batavia	1	6	7	39,86	± 0,13
Kangean		1	1	40,00	——
Tjilatjap 1	2	23	25	39,92	± 0,05
Tjilatjap 2		13	13	40,00	± 0,00

Table XXXIII gives the total numbers of vertebrae. As follows from the fore-going table each animal has 39 or 40, but most have 40 vertebrae. The averages are again very uniform.

Table XXXIV. *Stolephorus insularis oceanicus.* Number of Gillrakers.

Locality	Gillrakers							N.	Average	Standard error
	23	24	25	26	27	28	29			
Batavia		5	1	1				7	24,43	± 0,27
Kangean			1					1	25.00	—
Tjilatjap 1 . . .	9	14						25	23,56	± 0,10
Tjilatjap 2 . . .					6	6	1	11	27,61	± 0,17

As was the case with the other groups of *St. insularis* the number of gillrakers, given in Table XXXIV varies much. In the first place the sample Tjilatjap II is very different from Tjilatjap I and from Batavia. Evidently there are two groups among the material from Tjilatjap. Whether the samples Tjilatjap I and Batavia are different, is not quite sure. The difference is 0.89 ± 0.31 and is therefore statistically unsufficient. *Stol. ins. oceanicus* is very rare on the north coast of Java, so that my material from here was very limited.

Table XXXV. *Stolephorus insularis oceanicus.* Number of keeled Scutes.

Locality	Scutes								N.	Average	Standard error
	0	1	2	3	4	5	6	7			
Batavia						3	4		7	5,58	± 0,18
Kangean	1								1	0,00	—
Tjilatjap 1 . . .							24	1	25	6,04	± 0,03
Tjilatjap 2 . . .							11	2	13	6,15	± 0,10

The number of keeled scutes, given in Table XXXV, ranges from 0 to 7. In the table we see that there is only one specimen, from Kangean, with 0 scutes, but the whole Kangean-sample consists of this single one.

Between the samples Tjilatjap I and II there is no difference here. The difference between Tjilatjap I and Batavia is 0.46 ± 0.18, again not quite sufficient, as was the case with the gillrakers.

Summarising the conclusions drawn from the table for the *oceanicus* group we see again that the vertebrae are of no use here for the separation of races. The tables for the gillrakers and scutes however show that *St. insularis oceanicus* comprises several groups. The difference is most obvious between the samples, Tjilatjap I and II.

Considering the four groups of *Stolephorus insularis,* we may say that there is evidence, more or less strong, pointing to the existence of local groups within each of the four varieties. The numbers of gill-rakers offer the main difference between these groups. The numbers of vertebrae are of some use in *St. insularis insularis* only, in the three other varieties no differences have been found between them. The number of keeled scutes shows also a differentiation in some cases. The *insularis* variety is the most common of all and has the widest distribution, then follows *bataviensis* and next *baweanensis* and *oceanicus.*

Stolephorus indicus.

In *Stolephorus indicus* we can at once distinguish two varieties, one with an average of 20 + 21 = 41 vertebrae and the other with 21 + 22 = 43 vertebrae. I have dealt with them separately. (For other particulars see above under the description of *Stolephorus indicus*).

In the same way the existence of a bigger and a smaller variety with a similar difference in the numbers of vertebrae has been described by HUBBS for the Californian sardine (*Engraulis mordax*) [1]).

I propose to call the bigger group *Stolephorus indicus indicus* and the smaller one *Stolephorus indicus nanus.*

We will treat first of *Stolephorus indicus indicus,* the biggest of all Indian *Stolephorus* species.

Stolephorus indicus indicus.

Table XXXVI. *Stolephorus indicus indicus.* Praecaudal Vertebrae.

Locality	Vertebrae		N.	Average	Standard error
	21	22			
Banjuasin		1	1	22,00	——
Sunsang		1	1	22,00	——
Bantam		1	1	22,00	——
Batavia	1	24	25	21,96	± 0,04
Tjilamaja		8	8	22,00	± 0,00
Cheribon.		1	1	22,00	——
Kendal		7	7	22,00	± 0,00
Semarang		10	10	22,00	± 0,00
Kelampis I	1	1	2	21,50	——
Kelampis II		2	2	22,00	——
Kelampis III		4	4	22,00	——
Kumai.		7	7	22,00	± 0,00

Table XXXVI shows the numbers of praecaudal vertebrae. The averages are very uniform and nothing indicates the existence of separate races. *Stolephorus indicus indicus* has 21 or 22, but mostly 22 praecaudal vertebrae.

[1]) Fish Bulletin No 8. Fish and Game Commission State of California. See also Natuurkundig Tijdschrift voor Nederlandsch-Indië, Deel XCIII, 1933.

Table XXXVII. *Stolephorus indicus indicus.* Caudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	20	21	22			
Banjuasin		1		1	21,00	——
Sunsang		1		1	21,00	——
Bantam		1		1	21,00	——
Batavia	3	22		25	20,88	± 0.06
Tjilamaja		8		8	21,00	± 0.00
Cheribon		1		1	21,00	——
Kendal	2	5		7	20,72	± 0.17
Semarang		9	1	10	21,10	± 0.09
Kelampis I		2		2	21,00	——
Kelampis II		2		2	21,00	——
Kelampis III		4		4	21,00	——
Kumai		6	1	7	21,14	± 0.13

In Table XXXVII the numbers of caudal vertebrae are given. Again the averages are very uniform and there is no evidence of the existence of separate races. Mostly 21 caudal vertebrae are found, but the number varies from 20-22.

Table XXXVIII. *Stolephorus indicus indicus.* Total Number of Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	42	43	44			
Banjuasin		1		1	43,00	——
Sunsang		1		1	43,00	——
Bantam		1		1	43,00	——
Batavia	4	21		25	42,84	± 0,06
Tjilamaja		8		8	43,00	± 0,00
Cheribon		1		1	43,00	——
Kendal	2	5		7	42,72	± 0,17
Semarang		9	1	10	43,10	± 0,09
Kelampis I.	1	1		2	42,50	——
Kelampis II.		2		2	43,00	——
Kelampis III.		4		4	43,00	——
Kumai		6	1	7	43,14	± 0,13

About Table XXXVIII, which deals with the total numbers of vertebrae, the same can be said as about Table XXXVI and XXXVII. No statistical differences can be found. The total numbers of vertebrae ranges from 42 - 44, with the maximum at 43.

Table XXXIX. *Stolephorus indicus indicus.* Number of Gillrakers.

Locality	Gillrakers						N.	Average	Standard error
	20	21	22	23	24	25			
Banjuasin		1					1	21,00	——
Sunsang			1				1	22,00	——
Bantam		1					1	21,00	——
Batavia	5	18	2				25	20,88	± 0,10
Tjilamaja		7	1				8	21,12	± 0,11
Cheribon		1					1	21,00	——
Kendal		3	2	2			7	21,86	± 0,31
Semarang	1	4	5				10	21,40	± 0,30
Kelampis I.						2	2	25,00	——
Kelampis II.				2			2	23,00	——
Kelampis III.		4					4	23,00	——
Kumai.		7					7	21,00	± 0,00

The gillrakers, given in Table XXXIX, range from 20 - 25, the maximum being 21 and 22. The uniformity is on the whole fairly great as was the case with the vertebrae.

Only the samples from Klampis and, perhaps, Kendal show irregularities which might indicate differences. This is especially the case with sample I from Klampis with 25 gill-rakers. However, our material is too small to draw any further conclusions.

Table XL. *Stolephorus indicus indicus.* Number of keeled Scutes.

Locality	Scutes			N.	Average	Standard error
	4	5	6			
Sunsang.		1		1	5,00	——
Bantam		1		1	5,00	——
Bavavia	12	11	2	25	4,60	± 0,12
Tjilamaja	8			8	4,00	± 0,00
Cheribon	1			1	4,00	——
Kendal	6	1		7	4,14	± 0,13
Kumai	5	2		7	4,28	± 0,14

When considering the number of keeled scutes, dealt with in table XL, we find again some statistical differences. Batavia for instance shows a real differences with Tjilamaja (0.60 ± 0.12) but not with the other samples. As Kumai and Kendal show no mathematical differences with Tjilamaja, we probably have here again gliding differences. Most individuals have 4 or 5 scutes and sometimes 6.

Summarising the above facts we may conclude that according to the tables for the gillrakers and the keeled scutes, there are some indications to split *Stolephorus indicus indicus* into separate groups, but these indications are not convincing.

Stolephorus indicus nanus.

Table XLI. *Stolephorus indicus nanus.* Praecaudal Vertebrae.

Locality	Vertebrae		N.	Average	Standard error
	21	22			
Oleh-leh	2		2	21,00	—
Belawan Deli	5		5	21,00	± 0,00
Tjarita	2	1	3	21,33	—
Batavia	25		25	21,00	± 0,00
Cheribon.	2		2	21,00	—
Tuban.	2		1	21,00	—
Kelampis.	10	1	11	21,09	± 0,08
Wijnkoopsbay.	9		9	21,00	± 0,00
Ampenan.	23	2	25	21,08	± 0,05
Macassar.	25		25	21,00	± 0,00
Kumai.	1		1	21,00	—

The numbers of praecaudal vertebrae are given in table XLI. There are 21 - 22 praecaudal vertebrae per animal, but mostly 21. Statistical differences are not shown by the table.

Table XLII. *Stolephorus indicus nanus.* Caudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	19	20	21			
Oleh-leh		1	1	2	20,50	—
Belawan Deli		5		5	20,00	± 0,00
Tjarita	1	2		3	19,66	—
Batavia	1	23	1	25	20,00	± 0,00
Cheribon.		2		2	20,00	—
Tuban.		1		1	20,00	—
Kelampis.	1	10		11	19,92	± 0,08
Wijnkoopsbay.	1	7	1	9	20,00	± 0,16
Ampenan.	1	21	3	25	20,08	± 0,08
Macassar.		24	1	25	20,04	± 0,04
Kumai.		1		1	20,00	—

Table XLII gives the numbers of caudal vertebrae. The numbers vary from 19 - 21, but mostly we find 20. The averages are again very uniform and statistical differences are not found.

Table XLIII. *Stolephorus indicus nanus.* Total Number of Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	40	41	42			
Oleh-leh		1	1	2	41,50	——
Belawan Deli		5		5	41,00	± 0,00
Tjarita		3		3	41,00	——
Batavia	1	23	1	25	41,00	± 0,05
Cheribon.		2		2	41,00	——
Tuban.		1		1	41,00	——
Kelampis		11		11	41,00	± 0,00
Wijnkoopsbay.	1	7	1	9	41,00	± 0,16
Ampenan	1	20	5	25	41,16	± 0,09
Macassar.		24	1	25	41,04	± 0,05
Kumai.		1		1	41,00	——

Table XLIII gives the total numbers of vertebrae. Statistical differences are not found. Most specimens show a total number of vertebrae of 41, the limits lying between 40 and 42.

Table XLIV. *Stolephorus indicus nanus.* Number of Gillrakers.

Locality	Gillrakers					N.	Average	Standard error
	21	22	23	24	25			
Oleh-leh			1	1		2	23,50	——
Belawan Deli. . .		3	1	1		5	22,60	± 0,35
Tjarita			2	1		3	23,33	——
Batavia	1	11	7	5	1	25	22,76	± 0,19
Cheribon			2			2	23,00	——
Tuban			1			2	23,00	——
Kelampis		3	4	4		11	23,09	± 0,21
Wijnkoopsbay . .		4	5			9	22,56	± 0,16
Ampenan		11	12	2		25	22,64	± 0,12
Macassar		1	9	11	4	25	23,72	± 0,15
Kumai			1			1	23,00	——

In table XLIV the numbers of gillrakers are dealt with. They range between 21 and 25, with the maximum at 22 - 24. The averages vary between 22.56 ± 0.16 (Wijnkoopsbay) and 23.72 ± 0.15 (Macassar). They are somewhat higher than the averages for *St. indicus indicus.* The difference between the above named samples 1.16 ± 0.21, a real one. There is no difference between the Wijnkoopsbay sample and those from Belawan Deli, Batavia and Ampenan. All these seem to belong to one group. Kelampis has an average of 23.09 ± 0.21. It shows with Macassar a difference of 0.63 ± 0.26, statistically

not a real one therefore. The difference Kelampis-Wijnkoopsbay is 0.53 ± 0.26, again not a real one. We have to do here most probably with gliding differences, which cannot be used to separate different groups.

Table XLV. *Stolephorus indicus nanus.* Number of keeled Scutes.

Locality	Scutes					N.	Average	Standard error
	2	3	4	5	6			
Oleh-leh		2	1			2	3,50	
Belawan Deli . .		2	1	2		5	4,00	± 0,39
Tjarita			3			3	4,00	
Batavia	1	4	13	6	1	25	4,08	± 0,17
Cheribon			1		1	2	5,00	
Tuban				1		1	5,00	
Kelampis		1	10			11	3,92	± 0,08
Wynkoopsbay . .		1	7	1		9	4,00	± 0,16
Ampenan		2	15	8		25	4,24	± 0,11
Makassar		3	17	5		25	3,92	± 0,11
Kumai			1			1	4,00	

The numbers of abdominal keeled scutes treated of in Table XLV show no statistical differences. Mostly we find 3, 4 or 5 of them and occasionally 2 or 6. It is remarkable, that there is so much variability in the Batavia-sample, as the same fact may be seen in Table XLIV concerning the gillrakers. The question arises whether this sample is really homogeneous, but the single-topped curve does not confirm this.

Summarising the conclusions from the Tables XLI - XLV we can say that neither the vertebrae nor the keeled scutes can be used for distinguishing separate races. Only the differences in the averages of the gillrakers might point in that direction.

It is no easy matter to distinguish the specimens of the *indicus* or the *nanus* group from each other. We can say that all ripe specimens shorter than ± 17.5 cm belong to the *nanus* group, and all unripe specimens with a length of more than 14 - 15 cm belong to the *indicus* group (c.f. p. 323), but most specimens brought to the fishmarket are unripe. There are no taxonomic differences, nor can the number of keeled scutes or gillrakers give us absolute certainty either. As a fact only the number of vertebrae remains. Most specimens belong to the 41 or 43 group, but there are intermediate ones. These intermediate are —variations of the *indicus* variety or + variations of the *nanus* variety. I must admit, that I cannot distinguish these specimens. I have left them out in the tables given above except in those cases, when I had pure samples of one variety.

Stolephorus commersonii.

Table XLVI. *Stolephorus commersonii.* Praecaudal Vertebrae.

Locality	Vertebrae 19	20	21	N.	Average	Standard error
Labuan		1		1	20,00	———
Batavia		25		25	20,00	± 0,00
Kendal		3		3	20,00	———
Semarang	1	9		10	19,90	± 0,09
Tuban		1		1	20,00	———
Surabaja		10	1	11	20,09	± 0,08
Kelampis		2		2	20,00	———
Tjilatjap		25		25	20,00	± 0,00
Sunsang		4		4	20,00	± 0,00
Belawan Deli		5		5	20,00	± 0,00
Kumai		14	2	16	20,12	± 0,08

Table XLVI deals with the praecaudal vertebrae. *Stolephorus commersonii* can have 19, 20 or 21 of them, but by far the greater part has 20. The averages are very uniform, lying between 19.90 ± 0.09 (Semarang) and 20.12 ± 0.08 (Kumai). No facts are found pointing to the existence of separate races.

Table XLVII. *Stolephorus commersonii.* Caudal Vertebrae.

Locality	Vertebrae 18	19	20	N.	Average	Standard error
Labuan		1		1	19,00	———
Batavia	4	18	3	25	18,96	± 0,10
Kendal		2	1	3	19,33	———
Semarang		9	1	10	19,10	± 0,09
Tuban		1		1	19,00	———
Surabaja	1	9	1	11	19,00	± 0,12
Kelampis		2		2	19,00	———
Tjilatjap	2	17	6	25	19,16	± 0,10
Sunsang		3	1	4	19,25	± 0,21
Belawan Deli	1	4		5	18,80	± 0,17
Kumai	3	11	2	16	18,94	± 0,13

Table XLVII deals with the caudal vertebrae. There are 18,19 or 20 caudal vertebrae per individual, with the maximum at 19. The lowest average is 18.80 ± 0.17 (Belawan Deli) and the highest 19.33 (Kendal). No facts are found pointing to the existence of separate races.

Table XLVIII. *Stolephorus commersonii.* Total number of Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	38	39	40			
Labuan		1		1	39,00	—
Batavia	4	18	3	25	38,96	± 0,10
Kendal	1	2		3	39,33	—
Semarang	1	8	1	10	39,00	± 0,13
Tuban		1		1	39,00	
Surabaja	1	9	1	11	39,18	± 0,11
Kelampis.		2		2	39,00	—
Tjilatjap	2	17	6	25	39,16	± 0,10
Sunsang		3	1	4	39,25	± 0,21
Belawan Deli	1	4		5	38,80	± 0,17
Kumai	2	11	3	16	39,06	± 0,13

In table XLVIII the total numbers of vertebrae are given. Most animals show a total of 39 vertebrae, occasional ones 38 or 40. The averages range between 39.33 (Kendal) and 38.80 ± 0.17 (Belawan Deli). Calculation shows no differences. The vertebrae therefore cannot be used for the distinction of races in *Stolephorus commersonii.*

Tabel XLIX. *Stolephorus commersonii.* Number of Gillrakers.

Locality	Gillrakers				N.	Average	Standard error
	22	23	24	25			
Labuan			1		1	24,00	—
Batavia		7	17	1	25	23,72	± 0,09
Kendal	1	2			3	22,66	—
Semarang		4	6		10	23,60	± 0,14
Tuban.	1				1	22,00	—
Surabaja.		7	4		11	23,36	± 0,14
Kelampis	2				2	22,00	—
Tjilatjap.		9	15	1	25	23,68	± 0,10
Sunsang.		3	1		4	23,25	± 0,21
Belawan Deli		3	2		5	23,40	± 0,22
Kumai.		13	3		16	23,18	± 0,09

Table XLIX, dealing with the number of gillrakers, shows more variation than the tables dealing with the vertebrae. *Stolephorus commersonii* has 22 - 25 gillrakers. The most common number is 23 or 24. The averages range from 23.18 ± 0.09 (Kumai) to 23.72 ± 0.09 (Batavia), leaving out Labuan, Kendal, Tuban and Kelampis as these samples are too small to draw any conclusions from them. If we compare Batavia and Kumai we get 0.54 ± 0.13, a real

difference therefore. Batavia gives no statistical difference with Semarang, Tjilatjap, and Belawan Deli. With Surabaja and Sunsang the difference is somewhat greater, though statistically insufficient to draw conclusions. Kumai is statistically not different from Belawan Deli, Sunsang and Surabaja. Kumai has a difference of 0.50 ± 0.13 with Tjilatjap, 0.42 ± 0.16 with Semarang. We find, therefore, that there are real differences, as for instance the Kumai sample belongs to another group as the Batavia sample and is also different from the Tjilatjapsample.

If we consider the table we see that there is a group with a rather high average (Batavia, Semarang, Tjilatjap with 23.72, 23.60 and 23.68 respectively) and a group with a rather low average (Surabaja, Sunsang, Belawan Deli and Kumai with 23.36, 23.25, 23.40 and 23.18). Now it is remarkable that the samples of the latter group are all caught in or in the neighbourhood of big river-mouths. From this fact one feels inclined to conclude that *Stolephorus commersonii* has a somewhat lower number of gillrakers in the neighbourhood of rivermouths, viz. in more or less brackish water, than in the pure marine waters.

Unfortunately Belawan Deli holds the middle between the two. Whether the two groups, distinguished above, belong each to one single group or have to be subdivided again into several smaller ones, cannot be decided at the hand of the data available for the present.

Table L. *Stolephorus commersonii*. Number of keeled Scutes.

Locality	Scutes							N.	Average	Standard error
	0	1	2	3	4	5	6			
Labuan					1			1	4,00	———
Batavia				3	21	1		25	3,92	± 0,07
Kendal				1	2			3	3,66	———
Semarang				3	7			10	3,70	± 0,13
Tuban					1			1	4,00	———
Kelampis				1	1			2	3,50	———
Tjilatjap		1	4	3	14	1	1	25	3,44	± 0,23
Sunsang					4			4	4,00	± 0,00
Belawad Deli . .	1		1	1	2			5	2,60	± 0,67
Kumai				4	11		1	16	3,88	± 0,14

In table L we see the numbers of keeled abdominal scutes. The first thing we observe is the fact, that the individual number of scutes sometimes may vary fairly much. The number varies from 0 to 6, i.e. more than in any other species. There are again two groups to be distinguished. The samples from Batavia, Semarang, Sunsang and Kumai shows no statistical differences between each other. The averages are in most cases somewhat below four. The samples Tjilatjap and Belawan Deli have a much lower average and at the same time

these two samples show a greater variation. I think it better to postpone any conclusions regarding these deviations until we have more data at our disposal.

Summarising the facts given above we can say that *St. commersonii* is a very uniform species, with no great tendency to split into separate races. The only indication of something like this might be found in the fact that the individuals caught in brackish water have a somewhat lower number of gillrakers.

Stolephorus heterolobus.

Table LI. *Stolephorus heterolobus.* Praecaudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	21	22	23			
Labuan		12		12	22,00	± 0,000
Tjarita	2	16	2	20	22,00	± 0,100
St. Nicolaaspoint . . .	3	15	1	19	21,90	± 0,102
Bantam	2	12	2	16	22,00	± 0,125
Batavia	1	24		25	21,96	± 0,038
Tjiparage		5		5	22,00	± 0,000
Tjilamaja	9	16		25	21,64	± 0,096
Indramaju		4		4	22,00	± 0,000
Cheribon.		24	1	25	22,04	± 0,039
Sawudjadjar	1	11		12	21,91	± 0,080
Semarang		2		2	22,00	——
Japara.		21	4	25	22,16	± 0,072
Tuban	3	7		10	21,77	± 0,137
Kelampis		9	1	10	22,10	± 0,298
Pasuruan		5	1	6	22,16	± 0,153
Kangean.	1	21	3	25	22,08	± 0,078
Puger.		14		14	22,00	± 0,109
Tjilatjap.		1		1	22,00	——
Wijnkoopsbaai		1		1	22,00	——
Buleleng		24	1	25	22,04	± 0,039
Macassar	2	23		25	21,92	± 0,054
Singapore		25		25	22,00	± 0,000

In Table LI the numbers of the praecaudal vertebrae are given. Most specimens have 22 praecaudal vertebrae and relatively few animals have one more or one less. The range therefore lies between 21 and 23. The averages of the different samples are very uniform, the highest and lowest being 22.16 and 21.64 respectively. If we compare these two samples, from Tjilamaja (21.64 $\pm$ 0,09) and Japara (22.16 $\pm$ 0,07), we get 22.16 - 21.64 = 0.52 $\pm$ 0.11. As 0.52 is more than three times 0.11 mathematically we should conclude that we are dealing here with different races. Yet I think it better to wait with the conclusions until we have seen Table LII and LIII.

Table LII. *Stolephorus heterolobus*. Caudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	19	20	21			
Labuan	1	11		12	19,91	± 0,08
Tjarita	5	13	2	20	19,85	± 0,12
St. Nicolaaspoint . . .	2	15	2	19	20,00	± 0,10
Bantam	1	13	2	16	20,06	± 0,10
Batavia	4	21		25	19,84	± 0,07
Tjiparage		5		5	20,00	± 0,00
Tjilamaja	1	22	2	25	20,04	± 0,09
Indramaju	1	3		4	19,75	± 0,21
Cheribon.	2	21	2	25	20,00	± 0,08
Sawudjadjar	2	8	2	12	20,00	± 0,09
Semarang		2		2	20,00	——
Japara.	7	17	1	25	19,76	± 0,08
Tuban	1	7	2	10	20,10	± 0,16
Kelampis	1	9		10	19,90	± 0,29
Pasuruan	1	3	2	6	20,16	± 0,28
Kangean	5	18	2	25	19,88	± 0,10
Puger	4	9	1	14	19,78	± 0,14
Tjilatjap		1		1	20,—	——
Wijnkoopsbaai			1	1	21,—	——
Buleleng.	5	20		25	19,80	± 0,08
Macassar	7	18		25	19,72	± 0,08
Singapore	4	19	2	25	19,91	± 0,09

In Table LII the numbers of caudal vertebrae are dealt with. Most animals have 20 caudal vertebrae, and the limits are 19 and 21. The lowest and the highest averages are 19.72 ± 0.08 for the Macassar-sample and 20.16 ± 0.28 for the Pasuruan-sample. (The sample from the Wijnkoopsbay consisting of only one specimen, excepted). The difference is 0.44 ± 0.29. We have therefore no reason here to admit the existence of several races.

Table LIII. *Stolephorus heterolobus*. Total number of vertebrae.

Locality	Vertebrae			N	Average	Standard error
	41	42	43			
Labuan	1	11		12	41,91	± 0,08
Tjarita	5	13	2	20	41,85	± 0,12
St. Nicolaaspunt. . . .	3	15	1	19	41,90	± 0,10
Bantam	1	13	2	16	42,04	± 0,08
Batavia	5	20		25	41,80	± 0,08
Tjiparage		5		5	42,00	± 0,00
Tjilamaja	1	22	2	25	42,04	± 0,06
Indramaju	1	3		4	41,75	± 0,21
Cheribon.	1	22	2	25	42,04	± 0,06
Sawudjadjar	2	9	1	12	41,91	± 0,14
Semarang		2		2	42,00	
Japara.	5	17	3	25	41,92	± 0,11
Tuban	2	8		10	41,80	± 0,12
Kelampis.		10		10	42,00	± 0,00
Pasuruan	1	2	3	6	42,33	± 0,30
Kangean	4	18	3	25	41,96	± 0,10
Puger	4	9	1	14	41,78	± 0,14
Tjilatjap		1		1	42,00	——
Wijnkoopsbaai			1	1	43	——
Buleleng	4	21		25	41,84	± 0,07
Macassar	7	18		25	41,64	± 0,09
Singapore	4	19	2	25	41,92	± 0,09

Table LIII gives the total number of vertebrae. We see, that most specimens have 42 vertebrae in total, the limits being 41 and 43. The averages lie between 41.64 ± 0.09 (Macassar) and 42.33 ± 0.30 (Pasuruan). We find here the same as in Table LII. The difference is 0.69 ± 0.31. A real difference therefore does not seem to exist between the highest and lowest average.

The highest and lowest averages in Table LII and LIII are not the same as in Table LI but, of course, this is not necessary. Yet according to table LIII we must conclude, that in different regions there are different races. These races often present differences so small, that it is not possible with the statistical method to detect them. As a fact we find differences only between the highest and lowest averages and when comparing two samples at random the averages lie too near each other to draw any conclusions. It is probable that we have here many local races with gliding differences.

Table LIV. *Stolephorus heterolobus.* Number of Gillrakers.

Locality	Gillrakers 21	22	23	24	N.	Average	Standard error
Tjarita	1	10	8	1	20	22,45	± 0,12
Bantam	1	7	8		16	22,69	± 0,22
Batavia		14	11		25	22,44	± 0,09
Tjilamaja	3	11	11		25	22,32	± 0,14
Cheribon.		14	11		25	22,44	± 0,09
Sawudjadjar		5	7		12	22,58	± 0,14
Semarang		2			2	22,00	———
Pasuruan		3	2	1	6	22,77	± 0,19
Kangean	1	12	8	4	25	22,60	± 0,16
Tjilatjap		1			1	22,00	———
Wijnkoopsbay.	1				1	21,00	———
Buleleng		13	12		25	22,48	± 0,09
Macassar		5	13	7	25	23,08	± 0,13
Singapore	3	11	10	1	25	22,36	± 0,14

In Table LIV we see the numbers of gillrakers. These numbers range between 21 and 24 and the averages, all except one, between 22.36 ± 0.14 for Singapore and 22.77 ± 0.19 for Pasuruan. Here is no statistical difference. Macassar only, with an average of 23.08 ± 0.13, is different from the rest. When comparing Macassar with the lowest other average, i.e. Singapore (22.36 ± 0.14) we find 0.72 ± 0.19, a real difference. This is also the case if we compare Macassar with Buleleng or Batavia, but when comparing with Bantam or Pasuruan we find no statistical difference. We get, therefore, the same results as found in the Tables LI-LIII, viz. gliding differences.

Table LV. *Stolephorus heterolobus.* Number of keeled Scutes.

Locality	Scutes			N	Average	Standard error
	4	5	6			
St. Nicolaaspoint . . .	2	12	6	19	5,26	± 0,12
Bantam		10	6	16	5,37	± 0,11
Batavia	4	18	3	25	4,96	± 0,10
Cheribon.	7	11	7	25	5,00	± 0,14
Sawudjadjar	1	6	5	12	5,33	± 0,18
Semarang	1	1		2	4,50	—
Kangean	2	13	10	25	5,32	± 0,12
Tjilatjap		1		1	5,00	—
Wijnkoopsbay.		1		1	5,00	—
Buleleng.	3	13	9	25	5,24	± 0,13
Macassar	3	14	8	25	5,20	± 0,12

Table LV shows the numbers of keeled scutes. The most common number is 5 pro individual, though there are many with 6 and 7. The averages range between 5.37 ± 0.11 for Bantam and 4.96 ± 0.10 for Batavia. (I leave out the Semarang sample consisting of two specimens only). The difference is 0.41 ± 0.14, which gives some evidence of the existence of different local groups, though not so convincing as in the other tables. At any rate the differences are again of a gliding nature.

Stolephorus pseudoheterolobus.

Table LVI. *Stolephorus pseudoheterolobus.* Praecaudal Vertebrae.

Locality	Vertebrae			N	Average	Standard error
	22	23	24			
Monong		13	1	14	23,07	± 0,06
Penuba	4	9		13	22,70	± 0,12
Muntok		18	7	25	23,28	± 0,09
Tjarita	1	22	2	25	23,04	± 0,06
Bantam		8	1	9	23,11	± 0,10
Batavia	1	16	8	25	23,28	± 0,10
Ampenan		18	7	25	23,28	± 0,09
Macassar		1		1	23,00	—
Menado		4	21	25	23,84	± 0,07
Ambon	1	11	13	25	23,48	± 0,10

Table LVI shows the numbers of praecaudal vertebrae. Most animals have 23 or 24, a few 22. The averages range between 22.70 ± 0.12 for the sample from Penuba and 23.84 ± 0.10 for the sample from Menado.

The samples from the eastern half of the Archipelago seem to have a higher average than those from the western half.

The sample Penuba is probably different from the sample from Monong (0.37 ± 0.13) and the difference between Muntok and Penuba (0.58 ± 0.15) is very evident. The sample from Penuba therefore belongs very probably to a definite race, as between Monong, Muntok, Tjarita, Bantam, Batavia and Ampenan no difference can be found, at least not a real one, and all the above named samples, show an evident difference with Penuba.

If we compare the samples with a high average mentioned above, as for instance Ampenan (23.28 ± 0.09) with Ambon 23.84 ± 0.07), we find a difference of 0.56 ± 0.11, a real one. Menado and Ambon show a difference of 23.84 - 23.48 = 0.36 ± 0.13. We have here again some evidence, though not convincing, that we are dealing with different races. When comparing Ambon with Ampenan we get 0.20 ± 0.13, which gives no difference between the two samples, but if we compare Ambon with one of the lower averages, as for instance Tjarita, we get 0.44 ± 0.11 a real difference again.

Summarising, we may conclude that we have a race with a very low average near Penuba and one with a very high average in the sea near Menado, races which are clearly different from the remaining samples. Within these remaining samples, those from Monong, Muntok, Tjarita, Bantam, Batavia and Ampenan belong perhaps to one race (at least there are no statistical differences) and only Menado is somewhat different and seems to belong therefore to another race.

Table LVII. *Stolephorus pseudoheterolobus.* Caudal Vertebrae.

Locality	Vertebrae				N	Average	Standard error
	18	19	20	21			
Monong.		2	11	1	14	19,93	± 0,11
Penuba	1	3	8	1	13	19,70	± 0,19
Muntok.		11	14		25	19,36	± 0,10
Tjarita		4	19	2	25	19,92	± 0,09
Bantam.		2	5	2	9	20,00	± 0,22
Batavia.	1	12	12		25	19,44	± 0,11
Ampenan			15	10	25	20,40	± 0,10
Macassar				1	1	21,00	——
Menado.		9	12	4	25	19,80	± 0,14
Ambon		4	18	3	25	19,96	± 0,10

Table LVII deals with the caudal vertebrae. The lowest number found is 18, the highest 21 but most animals have 19 or 20 caudal vertebrae. Ampenan has the highest (20.40 ± 0.10) and Muntok (19.36 ± 0.10) the lowest average which is very near to that of the sample from Batavia. Penuba is not different from Monong (0.23 ± 0.21) and Muntok (0.34 ± 0.21) as was the case with

the praecaudal vertebrae, but Muntok and Monong give now difference of 0.57 ± 0.15. Ampenan is clearly different in this table from all other samples and thus, judging from the number of caudal vertebrae, the Ampenan sample belongs to a separate race. Menado and Ambon show no differences between each other, but there are differences between these two and some of the other samples as for instance the Batavia sample, though not the Tjarita sample.

Judging from the list of averages we are inclined to conclude, that in the first place we have a separate race in Ampenan and in the second place that we have in Batavia and Muntok samples which cannot be separated statistically from each other but which are fairly different from the remaining samples (Monong, Penuba, Tjarita, Bantam Menado and Ambon). These latter samples statistically belong to one group.

Table LVIII. *Stolephorus pseudoheterolobus.* Total Number of Vertebrae.

Locality	Vertebrae					N	Average	Standard error
	41	42	43	44	45			
Monong		2	10	2		14	43,00	± 0,13
Penuba	2	7	4			13	42,30	± 0,22
Muntok		8	13	4		25	42,84	± 0,13
Tjarita		2	22	1		25	42,96	± 0,06
Bantam		2	4	3		9	43,11	± 0,24
Batavia		5	18	2		25	42,72	± 0,12
Ampenan		1	7	17		25	43,64	± 0,10
Macassar				1		1	44,00	—
Menado		2	8	12	3	25	43,64	± 0,14
Ambon			14	11		25	43,44	± 0,10

In Table LVIII the total numbers of vertebrae are given. The numbers range between 41 and 45, most specimens in the western part of the archipelago (on the Sunda shelf) having 42 or 43 and the three samples (Ampenan, Menado, Ambon) from the eastern half of the archipelago having mostly 43 and 44, about the same result, therefore, as found in table LVI (praecaudal vertebrae). Statistically these three samples belong to one race but the high total number of vertebrae for Ambon and Menado is due to the high number of praecaudal vertebrae and for Ampenan to the high number of caudal vertebrae. We can safely conclude, therefore, that the sample of Ampenan belongs to a separate race different from the samples of Ambon and Menado. (Later on we will see, that Menado and Ambon also have to be separated from each other).

In the remaining samples (Monong, Penuba, Muntok, Tjarita, Bantam and Batavia), Penuba has the lowest average (42.30 ± 0.22), follows Batavia with 42.72 ± 0.12 and the rest has an average somewhat higher or lower than 43.00. Yet statistically there are no real differences. If we compare the highest and lowest average (Bantam and Penuba) we get a difference of 0.81 ± 0.28,

which is not sufficient to separate these two samples, nor the samples with averages between these two extremes.

Table LIX. *Stolephorus pseudoheterolobus.* Number of Gillrakers.

Locality	Gillrakers					N	Average	Standard error
	22	23	24	25	26			
Monong		5	8	1		14	23,72	± 0,15
Penuba , ...		5	7	1		13	23,70	± 0,16
Muntok		7	12	5	1	25	24.00	± 0,17
Batavia		6	15	4		25	23,92	± 0,09
Ampenan			1	15	9	25	25,48	± 0,13
Menado	6	14	3	2		25	23,04	± 0,16
Ambon			6	10	6	25	24,76	± 0,19

Table LIX shows the numbers of the gillrakers. The numbers vary from 22 - 26 per individual, but most frequently we find 23,24 or 25. The averages range between 23.04 ± 0.16 for the Menado-sample and 25.48 ± 0.13 for the Ampenan sample. In the tables for the vertebrae we found, that the Ampenan-sample with certainty belongs to a separate race and that the Ambon and Menado samples could not be separated. Here we see again that the Ampenan sample forms a separate group and that the Menado and Ambon samples not only are different from Ampenan but they are also different between each other. We have therefore to distinguish at least three different groups of *Stolephorus pseudoheterolobus* in the eastern half of the Archipelago. These races can be distinguished by the averages of the vertebrae but with more certainty by the averages of the gillrakers.

The gillrakers of the Bantam sample could not be counted for reasons given above. In the remaining samples (Monong, Penuba, Muntok and Batavia) no statistical differences can be found. They can give us no help therefore to overcome the difficulties met with in the tables above for separating these samples into definite races.

Table LX. *Stolephorus pseudoheterolobus.* Number of keeled Scutes.

Locality	Scutes			N.	Average	Standard error
	4	5	6			
Penuba	1	9	3	13	5,15	± 0,10
Muntok	2	18	5	25	5,12	± 0,10
Batavia	2	19	6	25	5,16	± 0,10
Ampenan	1	16	7	25	5,24	± 0,10
Ambon	3	12	10	25	5,28	± 0,13

Table LX, in which the numbers of keeled abdominal scutes are dealt with, gives us no new facts. I could get numbers from five places only, as the

other samples had the abdominal wall more or less lacerated, due to the quick decomposition (see above). *Stolephorus pseudoheterolobus* has 4 - 6, but mostly 5 abdominal scutes. Thus the range of variation is not very wide. The averages range between 5.12 ± 0.10 (Muntok) and 5.28 ± 0.13 (Ambon). Statistical differences cannot be detected, though a single glance at the table will show us, that there is again most probably a difference between the samples from the eastern and the western part of the Archipelago. The samples from Ampenan and Ambon, with the averages 5.24 (± 0.10) and 5.28 (± 0.13), form one group and the samples from Penuba, Muntok and Batavia, with the averages 5.15 (± 0.10), 5.12 (± 0.10) and 5.16 (± 0.10) resp. form a second group.

Summarising the facts given above, we can say, that two distinct groups of races can be distinguished in all tables. One group, consisting of three separate races, occurs in the deep waters of the eastern part of the Archipelago and another group of races in the seas of the Sundashelf. This latter group can not be separated so easily into races, but there is evidence, which points in this direction. We are dealing here, as was the case with *Stolephorus heterolobus* with gliding differences.

Stolephorus zollingeri.

My material of *Stolephorus zollingeri* consists of three samples. The localities Puger, on the south coast of Java, Menado in Celebes and Ambon in the centre of the Moluccas are situated very far apart from each other. The natural conditions will be about the same. The samples are caught near a rocky and high coast where the seabottom drops very steeply to several hundred meters. The Puger-sample is too small to be used statistically.

Table LXI. *Stolephorus zollingeri*. Praecaudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	23	24	25			
Puger.		2		2	24,00	———
Ambon	1	11	13	25	24,48	± 0,10
Menado		14	2	16	24,12	± 0,08

In table LXI the number of praecaudal vertebrae is given. They range from 23 - 25, with the maximum at 24 or 25. The difference between the averages from Menado and Ambon is 0.36 ± 0.13. We have therefore some probability, but no certainty, that the two samples belong each to a separate race.

Table LXII. *Stolephorus zollingeri.* Caudal Vertebrae.

Locality	Vertebrae 17	18	19	N.	Average	Standard error
Puger.		2		2	18,00	——
Ambon	5	18	2	25	17,88	± 0,10
Menado		11	5	16	18,31	± 0,11

Table LXII deals with the numbers of caudal vertebrae, which range from 17 - 19, with the maximum at 18. The difference between the Ambon and Menado-samples is now 0.43 ± 0.15, again not quite sufficient to separate two races.

Table LXIII. *Stolephorus zollingeri.* Total Number of Vertebrae.

Locality	Vertebrae 41	42	43	44	N.	Average	Standard error
Puger.		2			2	42,00	——
Ambon	4	9	11	1	25	42,36	± 0,09
Menado		9	7		16	42,44	± 0,10

Table LXIII gives the total number of vertebrae. Mostly we have 42 - 43 and in some cases 41 or 44. The difference between the averages from Ambon and Menado is too small to justify the separation into two single races.

Table LXIV. *Stolephorus zollingeri.* Number of Gillrakers.

Locality	Gillrakers 23	24	25	N.	Average	Standard error
Puger.		1	1	2	24,50	——
Ambon	4	10	11	25	24,36	± 0,16

The number of gillrakers given in Table LXIV, amounts from 23 - 25, with the maximum at 24 and 25. The gillrakers from the Menadospecimens could not be counted.

Table LXV. *Stolephorus zollingeri.* Number of keeled Scutes.

Locality	Scutes 4	5	6	N.	Average	Standard error
Puger.	1	1		2	4,50	——
Ambon	1	15	6	25	5,08	± 0,12

In table LXV the number of keeled abdominal scutes are given. They range from 4 - 6, with the maximum at 5. Again the Menado-specimens could not be used as they were badly preserved.

Summarising the facts given above, we must state that no reliable conclusions can be drawn, before we have more material at hand.

Stolephorus celebicus.

My material of *Stolephorus celebicus* consists of one single sample from Menado only. Nothing can be said therefore about the existence of local races. For the sake of convenience, however, I have treated this species in the ordinary way and given the numbers of the vertebrae and gillrakers in tables. The number of keeled abdominal scutes could not be counted.

Table LXVI. *Stolephorus celebicus.* Praecaudal Vertebrae.

Locality	Vertebrae			N.	Average	Standard error
	23	24	25			
Menado	3	19	3	25	24,00	± 0,09

Table LXVI gives the number of praecaudal vertebrae. Mostly there are 24 of them and sometimes 23 or 25.

The average is 24.00 ± 0.09.

Table LXVII. *Stolephorus celebicus.* Caudal Vertebrae.

Locality	Vertebrae				N.	Average	Standard error
	18	19	20	21			
Menado	3	8	12	2	25	19,52	± 0,16

Table LXVII gives the number of caudal vertebrae. We may count 18-21 of them, but mostly 19 or 20. The average is 19.52 ± 0.16.

Table LXVIII. *Stolephorus pseudoheterolobus.* Total Number of Vertebrae.

Locality	Vertebrae				N.	Average	Standard error
	42	43	44	45			
Menado	3	7	14	1	25	43,52	± 0,15

Table LXVIII shows the total number of vertebrae, ranging from 42 - 45 with the maximum at 44. The average is 43.52 ± 0.15.

Table LXIX. *Stolephorus pseudoheterolobus.* Number of Gillrakers.

Locality	Gillrakers				N.	Average	Standard error
	23	24	25	26			
Menado	1	8	11	5	25	24.80	± 0,16

Table LXIX deals with the number of gillrakers, of which we count in most cases 25 or 24 and sometimes 26 or 23. The average is 24.80 ± 0.16.

V. SUMMARY AND CONCLUSIONS.

As a consequence of the investigations dealt with in the present paper the number of species of the genus *Stolephorus* known from the Indo-Australian Archipelago has risen to nine.

These nine species are:

1 *Stolephorus tri.*
2 „ *baganensis.*
3 „ *insularis.*
4 „ *indicus.*
5 „ *commersonii.*
6 „ *heterolobus.*
7 „ *pseudoheterolobus.*
8 „ *zollingeri.*
9 „ *celebicus.*

Four species, viz. *St. baganensis, insularis, pseudoheterolobus* and *celebicus* are new and are described for the first time by me in Natuurkundig Tijdschrift voor Nederlandsch Indië, Deel XCIII, 1933. The five other species are redescribed.

These nine species can be arranged into four groups of a closer natural relationship.

The groups are:

I. *Stolephorus tri* and *baganensis.* They are characterized by the high and compressed body. The number of praecaudal vertebrae is about the same as the number of caudal vertebrae; the anus lies just in the middle, the trunk is just as long as the tail. (The tail in *St. tri* is in a few cases even one vertebrae longer than the trunk). A little spine is present in front of the dorsal fin, the maxillary is pointed and reaches to the gillopening. Planctonic eggs oval, containing an oil-globule. Moderate length when adult. Most common in or near rivermouths. Rather rare along other parts of the coast.

II. *Stolephorus insularis, indicus* and *commersonii.*

Body not so compressed as in the foregoing group. Rather large fishes when adult (*St. indicus* even to 16 - 17 cm!) The trunk is in most cases one vertebra longer than the tail. The anus being situated slightly more backwards

when compared with the first group. The maxillary is pointed and reaches to the mandibulary joint in *St. indicus,* to the gillopening in *insularis* and *commersonii.* Planctonic eggs oval, egg membrane with a knob at the animal pole. Rather rare in or near rivermouths. More common along other parts of the coast.

III. *Stolephorus heterolobus* and *pseudoheterolobus.*

Rather small fishes with a subcylindrical body. The trunk is in the group 2 - 3 vertebrae longer than the tail. The anus is situated slightly more backwards again than in the second group. The maxillary is pointed and reaches to the mandibulary joint. Planctonic eggs oval, *St. pseudoheterolobus* without, *St. heterolobus* with a very small oil-globule. Not found in or near rivermouths. Common along other parts of the coast. *St. heterolobus,* judging from the pelagic eggs, nearer to the shore. *St. pseudoheterolobus* especially common in the waters of the Riau and Lingga-archipelago where *St. heterolobus* seems to be absent altogether. Where *St. heterolobus* is common, *St. pseudoheterolobus* is rare.

IV. *Stolephorus zollingeri* and *celebicus.*

Fishes of a moderate length with a subcylindrical, elongated body. The trunk is here 4 - 7 vertebrae longer than the tail, the anus being situated more backward than in any of the other three groups. The maxillary is rounded and reaches to the mandibulary joint. Ovarial eggs oval, without a knob, not yet known from the plancton. These species seem to occur more especially in the eastern part of the Indo-Australian Archipelago in waters with a constant and high salinity.

In general we see within the group of the *Malacopterygians* (of wich the *Clupeids* are the best known in this respect), that those species which are the more primitive have a high total number of vertebrae and the anus has a backward position, the number of praecaudal vertebrae being relatively high, when compared with the number of caudal ones. The less primitive forms have in general fewer vertebrae and the anus has shifted more or less forward, the number of praecaudal vertebrae having decreased when compared with the number of caudal vertebrae. This conception of the evolution (see e.g. JORDAN "A Guide to the study of Fishes") is supported by the development. During the larval development we see that the anus shifts forward as has been shown by Prof. DELSMAN in several instances for the Clupeids. (See his various papers on this subject in Treubia from 1923 to now).

At the same time we see within many *Clupeid* genera occurring in the Indo-Australian Archipelago, that the species with pelagic habits have a long, slender body and high total number of vertebrae and that the shore-forms have a higher and shorter body and often a lower number of vertebrae. The position of the anus in the latter is proportionately more forward.

If we consider now the four groups of *Stolephorus* mentioned above, we see that in the fourth group there are fewer caudal vertebrae than praecaudal ones (see in this respect the tabel on page 316). The body is almost cylindrical,

long and slender. The species belonging to this group frequent especially the eastern part of the Archipelago, where the salinity of the sea is little or not influenced by big rivers, being regularly $34^0/_{00}$ or more.

The third group consists of long and slender fishes too, but the total number of vertebrae is smaller, the difference between praecaudal and caudal vertebrae is likewise smaller. The tail, therefore, is relatively longer, the trunk shorter and the anus has shifted somewhat forward, when compared with the foregoing group. The species live near the coast in the western part of the Archipelago where, as a rule, the water has a salinity of less than $34^0/_{00}$ as a consequence of the many rivers, which empty here into the sea. The species are never found, however, within or near a rivermouth.

The second group has in general again fewer vertebrae than the third one, the tail is relatively longer, the anus having again shifted somewhat more foreward. The shape of the body holds the middle between the long slender form of the third group and the high and compressed shape of the first group (see below). The species of this group live in the sea near the shores and sometimes enter the rivermouths.

In the first group we see that the number of tail vertebrae is equal to that of the trunk now and in some cases even slightly higher. The anus has again shifted to the foreward and the total number of vertebrae is the lowest found in any of the four groups. The body is high and compressed. The species of this group live almost exclusively in or near rivermouths, being rare on other parts of the coast.

From the facts given above, in accordance with the embryological data found by Prof. DELSMAN, we feel inclined to consider the long slender forms of the open sea as the more primitive and the higher coastal forms as to be derived from them. In agreement with this we might conclude that there has been during the evolution in the genus *Stolephorus* a migration from the open sea towards the coast and into the tidal rivers. Most primitive, then, would be *Stolephorus zollingeri* and *celebicus,* whereas *Stolephorus baganensis* and *tri* would be the youngest species.

Three of the nine species of *Stolephorus* dealt with in this paper have been divided by me into smaller units, viz. *Stol. baganensis, insularis* and *indicus.*

Stolephorus baganensis has been divided into two varieties called *St. baganensis baganensis* and *St. baganensis macrops.* The two varieties can be distinguished taxonomically.

Stolephorus insularis can be divided into four varieties.

Stolephorus insularis insularis, St. insularis bataviensis, St. insularis baweanensis and *St. insularis oceanicus.* Only *St. insularis oceanicus* can be distinguished by external features as this variety has practically no pigment. The others are distinguished mainly by the varying number of vertebrae, *insularis* having mostly $20 + 19 = 39$, *bataviensis* $21 + 20 = 41$ and *baweanensis* $20 + 20 = 40$ vertebrae (*oceanicus* has $20 + 20 = 40$ vertebrae too).

Stolephorus indicus can be divided into two varieties *St. indicus indicus* and *St. indicus nanus,* having $22 + 21 = 43$ and $21 + 20 = 41$ vertebrae respectively. *Indicus indicus* is much longer when adult than *nanus.* Externally there are no differences.

The occurrence of a larger and a smaller variety of a given species, with a corresponding difference in the number of vertebrae, has been described by HUBBS (Fish and Game Commission of the State of California, Fish Bulletin No. 8) for *Eugraulis mordax* [1]), which is divided by him into two subspecies: *E. mordax mordax* and *E. mordax nanus.* His *Engraulis mordax* is an *Engraulis* which very closely resembles a *Stolephorus* species judging from the figure.

It is obvious that we have in *St. indicus* a similar state of things and within *St. insularis* we can distinguish in the same way the three varieties, viz. *St. insularis insularis, bataviensis* and *baweanensis.* (See also page 338).

Among all the varieties summed up above only *St. insularis oceanicus* and *St. baganensis baganensis,* together with *St. baganensis* macrops, can be distinguished by external and not by internal features.

I have given all the above named varieties [2]) a subspecific rank by using a second name behind the proper speciesname. Now the terminus "subspecies" is practically identical with what is called by many newer authors. (RENSCH "Das Prinzip geographischer Rassenkreise und das Problem der Artbildung" Berlin 1929) a "geographical race".

SCHNAKENBECK, ("Zum Rassenproblem bei den Fischen", Zeitschrift für Morphologie und Ökologie der Tiere, Bnd. 21, 1931) in his fine paper on the races of the European herring applies the principle of the geographical races to the herring and consequently puts a second name behind the old speciesname *Clupea harengus.* The difference between his geographical races are not so clear and easy to be seen as in my subspecies, but each of his races is one statistical unit; which is not the case with my subspecies. Within *St. baganensis baganensis,* for instance, real statistical differences can be found in the number of vertebrae among samples from different localities and even among samples from one locality (Batavia!). It is obvious, therefore, that my subspecies are not always quite identical with the so called geographical races.

The geographical races as distinguished by SCHNAKENBECK have each their own spawning area. According to the investigations of Prof. DELSMAN this is to some extent the case with *St. baganensis baganensis* and *St. baganensis macrops* (see also above page 320). About the spawning area of the subspecies of *St. insularis* nothing is known and nothing is known either with any certainty of *St. indicus.*

Although the systematic rank of my subspecies is not quite certain, as I pointed out above, I should prefer to maintain my nomenclature for some time to come for practical reasons. Later on when much more is known about

[1]) See also note on page 352.
[2]) I have used thus far the term „variety" only in a quite neutral sence. The word variety did not express the systematic position.

the biology (spawning habits) it has to be decided which of my subspecies really constitutes a geographical race and which of them form a separate species or even a separate "Rassenkreis". Subjective feeling, however, can never be put entirely out of consideration.

In the foregoing pages I have spoken of local races in those cases when statistical differences could be calculated from the numbers of vertebrae. In northern, temperate, waters many facts were found, which render it probable that the number of vertebrae is hereditary.

If this be true in every respect for tropical waters too, where the development is so much more rapid, is not sure as far as yet. Perhaps some of the sometimes very small statistical differences, found above, might be due to external factors only. I think it better, therefore, for the moment to confine myself to stating the facts and to postpone any further speculations.

Besides the numbers of vertebrae also the numbers of gillrakers and keeled abdominal scutes have been dealt with statistically in the present paper. They show us, that we can distinguish many local groups of specimens or populations. As the variation of these numbers may be due not to hereditary factors only but to some extent to external conditions during the development also, we may not lay too much stress upon eventual differences. Only in some cases, as for instance with *St. baganensis baganensis*, where the number of gillrakers is much lower in the Sumatra-specimens than in the Java-specimens the difference can hardly be ascribed to external influence only.

MAP OF JAVA SHOWING LOCATION OF RESIDENCIES.

1 : 6.000.000

I. Bantam
II. Batavia
III. Buitenzorg
IV. Priangan
V. Cheribon
VI. Pekalongan
VII. Banjoemas
VIII. Kedoe
IX. Samarang
X. Klaten
XI. Jogjakarta
XII. Japara-Rembang
XIII. Soerakarta
XIV. Madioen
XV. Bodjonegoro
XVI. Kediri
XVII. Soerabaia
XVIII. Malang
XIX. Probolinggo
XX. Besoeki

AN ANNOTATED LIST OF THE *ODONATA* OF JAVA,
with notes on their distribution, habits and life-history.

By

M. A. LIEFTINCK

(Zoölogisch Museum, Buitenzorg).

The first collector whose name should be quoted as having captured *Odonata* in Java is C. G. C. REINWARDT, a reputed botanist, whose stay in the island was of brief duration. Most of his collections were lost when on their way to Europe, but fortunately the material gathered by him during 1819-1821 came safely into possession of the Leiden Museum.

Considerable collections were also made by two well known zoologists, H. KUHL and J. C. VAN HASSELT, who travelled all over the country from 1821 to 1823, assembling material in different parts of the island. Few years later, S. MÜLLER arrived in Java, and this enthousiastic explorer paid much attention to insects generally; his dragonflies were collected mainly, I believe, in Buitenzorg and Krawang from 1826 to 1827 and from 1830 to 1833.

Lastly, the names of HILLEBRAND, HEKMEIJER, VAN LANSBERGE, and a few others should be quoted as being repeatedly mentioned on the labels of old specimens kept in the Leiden Museum. Apparently, the first two collectors mainly explored the mountains of East Java.

Now, it is interesting to learn that several of these old collections have never been worked out, and although H. ALBARDA identified some of the commoner forms, the majority of specimens remained unnoticed in the store-rooms of the Leiden Museum.

After this, there seems to have been a long pause in the history and it was not before the close of the former century that H. FRUHSTORFER made very important collections in the southwestern parts of the island, including a few species which have never turned up again. Many of his captures, which now are in the Brussels Museum, are described as new species by DE SELYS LONGCHAMPS and the writer, and full use was made of the Libellulines and Aeschnids among them by F. RIS and R. MARTIN, who published their results in the magnificent Selysian 'Catalogues'. Next to FRUHSTORFER's insects, the only important additions to the Javan Odonate-fauna were made by EDW. JACOBSON, who obtained small samples in various districts, collected by himself from 1908 to 1911. Along with some interesting larval forms, this collection was discussed in detail by RIS in a special memoir (86).

Lastly, in this Recueil (Vol. 8, 1926, pp. 467-494), F. C. FRASER has published a brief account of the Dragonfly-fauna of our island, describing some new forms and listing 79 species. Unfortunately, FRASER's attempt of stock-taking was unsatisfactory and incomplete, owing to the fact that many of the older records, including all RIS's publications, remained unnoticed by him, most of the species described as new being not collected in Java. The necessary corrections to this list will be found incorporated in the present paper, arranged in an 'Appendix'.

In addition to records already available in the literature and the above, I have been able to compile my list from the examination of the large amount of old and partly undetermined material preserved in the collections of the Amsterdam and Leiden Museums, and in the Brussels Museum, formerly DE SELYS' collection. I am glad to have been given the opportunity of making a fresh list chiefly based on the collections made for me by Messrs. F. C. DRESCHER (Bandoeng), H. LUCHT (Bondowoso), G. OVERDIJKINK (formerly Soekaboemi), L. J. TOXOPEUS (Bandoeng), Mrs. M. E. WALSH (Soekaboemi) and many other collectors, to whom I owe my sincerest thanks for their valuable assistance. Especially Mr. DRESCHER has contributed largely to our knowledge of the present fauna. Although I have had myself no sufficient opportunities whatever for making extensive collections, I have thought it worth while to include in my list not only the known localities and names of species represented in the collection, but also, as a result of random field work, brief notes on the biology, carried on as opportunity permitted and assembled almost entirely on Sunday-trips or week-end excursions, mostly in the surroundings of Buitenzorg. A more penetrating study of Odonate-life was made by me only in the Botanical Garden at Buitenzorg, in the Karimoen Djawa Archipelago, and on the Salak and Gedeh Mountains. A review of the pages which follow will show how incomplete my own observations on the biology still are. Without the aid of, especially, FRASER's most interesting field-notes on Indian species, to which references were made in many instances, it would have been impossible to get some impression of the chief peculiarities of each species. Otherwise, in order to avoid undue prolixity of the list, I have given references exclusively to f a u n i s t i c papers, under the head of each species, the numbers following the name of an author referring to the full citations in the bibliography.

This paper makes no attempt to summarize completely all the material (over 13,000 specimens!) studied by myself, but to make it sufficiently useful I have without exception put on record all localities known to me applying to the less common or otherwise imperfectly known species. The localities are arranged somewhat in a topographical and also in a physiographical order, tracing them from west to east, each series of localities being followed by a roman cipher, which denotes the residency in which they are situated, and indicating roughly their geographical position (see map).

I have tried to make my list complete, that is, every species is recorded that has a satisfactory claim to be included. Doubtful records and species whose

systematic position is called in question are definitely removed from the list; experience learns that such doubtful records lead a persistent life in literature, and therefore I feel myself authorized to abandon their names. Species whose occurrence in the island is beyond dispute but of which I have not seen authentic material, are very few in number. Not to mention two species which will soon be described by Dr. SCHMIDT, these are: — *Caconeura humeralis* (SELYS), *Tetrathemis platyptera* SELYS, *Onychothemis abnormis* BRAUER, and *Gynacantha limbalis* KARSCH.

Of a total of 142 species known to occur in Java, 22 (including SCHMIDT's new species) are here recorded for the first time, and although one might possibly find this list to be fairly exhaustive on comparing it with the totals of species known from the neighbouring Sondaic Islands, I am deliberately of opinion that m a n y more species will come to light. Several districts of Java have as yet remained practically unexplored. Speaking generally, we can say that no serious collecting has ever been done in the northern residencies of the island, except in N. Bantam, the western half of Batavia and in Samarang. In South Java little is known from Bantam, the virgin forests of South Priangan, and almost nothing from the entire southern hill-ranges in the residencies XI, XIII, XIV, XV, XVI and XVII, the fauna of the southern part of Djember being also entirely unknown.

A comparison of the Odonate-fauna of Java with that of the three other big landmasses, viz., the Malay Peninsula, Sumatra and Borneo, which together are known as the S o n d a i c a r e a, meets with difficulties of various kind.

It is often held that dragonflies and other winged insects, such as *Diptera* and butterflies, should have strong powers of flight and accordingly are not expected to have a limited distribution. In a general way, "Dragonflies" and "Butterflies" indeed are strong fliers, but it is often lost sight of that the actual distribution of such insects is determined by the conditions under which the early stages are able to exist. Now, one must bear in mind that a fair percentage (over 30%) of our regional *Odonata* passes through larval stages which have exclusively rheophilous habits or live in clear, well aerated waters at rather high altitudes. Summarizing conclusions relating to geographical distribution are therefore not to be founded on migratory species or on those which have adapted a life in brackish water, but will rest only on those purely fresh-water forms which do not wander far from the waters in which they have passed their earlier stages or in which their offspring are capable of surviving. Examples of this kind are far more numerous than has generally been accepted. The family *Platystictidae* for instance, stands for apart from other *Zygoptera* and is of great zoogeographical interest. It is represented in Malaysia by two genera, *Drepanosticta* and *Protosticta*, which in their habitats are highly remarkable in that they are entirely restricted to the tropical rainy forest areas. The adults are small and excessively slender insects with a very weak flight which do not wander far from their breeding-places and are only found by patient explorers who are not deterred by a prolonged search in one

limited spot. Of *Drepanosticta* four species, all endemic, are now known to occur in Java, and all except *D. sundana* have a very limited distribution in the island. In Borneo no less than six endemic species have been discovered, but from Sumatra only two species are known, both being peculiar to the island. Further investigations in the Sondaic Islands will doubtlessly result in the discovery of many new species and a study of their relationships will, as stated before, probably prove of high zoogeographical value. The genus *Protosticta* has one endemic species in the Malay Peninsula and three in Borneo; it is absent from Java and Sumatra.

Similar examples of slow wanderers inhabiting small areas are the *Libellaginidae, Euphaeidae* and *Calopterygidae* whose members dwell in running waters, like the species of *Coeliccia,* the *Protoneuridae,* and probably also the genera *Macromia* and *Idionyx* among the *Corduliinae.* As has been stated before, our knowledge of the fauna of the islands under discussion is still very scanty, and it is not intended here to comment upon the relations of Odonate distribution to temperature, rainfall and other environmental factors as showing the limits which these factors set to the distribution of the insects in question. First of all many more forest- and stream-dwelling species should be traced.

On the other hand, we may be said to know where many species occur, but not where they do not occur. With the alarming progress in the clearing of primeval forests and drainage of virgin swamps and rivers we must probably expect the disappearance of many *Odonata,* and therefore a comparative and very careful investigation of such areas should soon be carried out, before any generalizations concerning their distribution can be made.

Yet, a few general observations on the proportionate numbers of Malaysian *Odonata* will not be out of place here.

Malay Peninsula. — LAIDLAW has recently listed 164 species occurring in the Malay States, inclusive of his later additions (64). To these I have added *Vestalis lugens* SELYS, from Kwala Kangsar, Perak and *Rhyothemis pygmaea* (RAMB.) [1]. The total number of known species, inclusive of *Drepanosticta silenus* LAIDLAW, from Perak, thus amounts at least to 167 species.

Sumatra. — The Odonate-fauna of this island is very imperfectly known. A critical survey is in course of preparation by the writer, and although my list of known species now includes already 180 different forms, it is safe to say that not more than 75% of its fauna has as yet been discovered.

Borneo. — Although LAIDLAW in 1931 has listed no less than ca. 180 species, we can safely admit that the extremely rich dragonfly-fauna of this island has by no means woıked out sufficiently, only British North Borneo and Sarawak being fairly well known at present. Some idea of how little the island has been worked may be gained by taking the Western Residency as an example. This country is inhabited by at least 135 species, and of these about 30 belong to undescribed species or to forms not so far reported from the island. We may estimate the actual number of Bornean species at about 250, or even more.

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[1]) M. A. LIEFTINCK, The *Odonata* of Nias Island. Misc. Zool. Sum., 59, 1931.

Java, with 142 species, makes no poor figure, although one of the most obvious features of the Java fauna is its relative poverty in comparison with that of the surrounding Sondaic Islands. This general poverty is especially evident on considering that Java, proportionally, has rather thoroughly been explored, and the total number of *Odonata* living in the island will not, I think, exceed much over 150 species.

In the next table I have entered the totals of all species, classed with their families, occurring in the Malay Peninsula, Sumatra, Java and Borneo. For convenience' sake in this table the *Agrionidae* and *Libellulidae* have been subdivided into their regional sub-families. With the exception of the numbers given for the Malay Peninsula, these totals are entirely new and have been obtained by adding up to the existing lists all species not previously recorded but represented in the Buitenzorg Museum collection, including several undescribed forms.

Family or Sub-family	Malaya	Sumatra	Java	Borneo
Calopterygidae	5	5	2	4
Euphaeidae	4	7	2	7
Libellaginidae	9	15	6	16
Amphipterygidae	1	1	—	1
Lestidae	2	2	3	2
Megapodagrionidae	2	3	1	5
Platystictidae	8	2	4	9
Protoneurinae	6	8	4	19
Platycneminae + *Agrioninae*	29	35	30	35
Corduliinae	8	6	11	10
Libellulinae	66	62	48	62
Cordulegasteridae	1	2	1	3
Gomphidae	14	17	15	19
Aeschnidae	12	15	15	21
Total	167	180	142	213

Taking the first four families together, the scantiness in Java of stream-dwelling 'Calopterygids' (*sens. lat.*) is at once evident. Malaya thus counts 19, Sumatra and Borneo each 28, and Java only 10 species. While Malaya partly owes its sum total to the mainland of Asia, Sumatra and Borneo both have a high percentage of precinctive species of *Euphaea*, *Rhinocypha* and *Libellago*, all conspicuous and not easily overlooked insects. The *Platystictidae* and *Corduliinae* are fairly well represented by a number of endemic species, but many others should occur in the surrounding islands, especially in Sumatra. Probably as a result of the rapid deforestation of the Javan lowlands, many typically malaysian *Libellulinae*, which in former times doubtlessly occurred

in the island, nowadays are no more in existence, or at any rate are so scarce as to be almost untraceable.

As will be seen from our general list, the majority of species has been recorded from West and Mid Java, whereas in East Java various species have not been found. These differences are, I think, mainly to be explained by the western parts of the island being more thoroughly investigated than East Java. An analysis of the Odonate fauna of Java brings to light a fairly high percentage of endemic species (not subspecies!), 28 or 19.7 per cent being confined to the island. These are: —

Rhinocypha fenestrata
——— *heterostigma*
Rhinagrion tricolor
Platylestes heterostylus
Drepanosticta gazella
——— *siebersi*
——— *spatulifera*
——— *sundana*
Caconeura delicatula
Coeliccia lieftincki
Pseudagrion infracavum
——— *nigrofasciatum*
Agriocnemis minima
Aciagrion fasciculare
Gomphidia javanica
Megalogomphus junghuhni
Onychogomphus banteng
——— *thienemanni*
Burmagomphus inscriptus
Burmagomphus javicus
Macrogomphus parallelogramma
Amphiaeschna ampla
Gynacantha stenoptera
Anaciaeschna montivagans
Orthetrum silvarum
Aethriamanta aethra
Macromia gerstaeckeri
——— *septima*

Some — if not many — of these may occur also in Benkoelen and the Lampong districts of South Sumatra; this is a very rich country whose fauna shows much of a mixed character, being inhabited also by a number of common Javan forms previously considered precinctive to that island (e.g. *Vestalis luctuosa, Euphaea variegata, Notoneura insignis, Aciagrion aciculare, Procordulia artemis, Ictinus decoratus, Heliogomphus drescheri*).

Of the 142 species recorded, 65 or 45.8 per cent are purely Malaysian (i.e. confined to the Malay Peninsula, Sumatra, Java, Borneo and Palawan, inclusive of their satellite islands and Bali), whilst of the genera only *Pericnemis* and *Orchithemis* are confined to Malaysia.

Other conclusions drawn from a study of the Odonate fauna of Java would seem to be premature and are better postponed until later.

Buitenzorg, September 1934.

N.B. — Since the present paper was handed over to the printers, I had a letter from Dr. ERICH SCHMIDT, in Berlin, who will soon publish the odonatological results of the "Deutsche limnologische Sunda-Expedition 1828/29" in the "Tropische Binnengewässer", Bd. V. Dr. SCHMIDT kindly acquainted me with the names and localities of *three* new Javan species he will describe, allowing me to insert their names throughout the text of this paper and making our knowledge of the Javan fauna up to date. With regard to the forthcoming report of Dr. SCHMIDT, further changes in the text of my "Annotated List" have not been made.

Sub-ordo ZYGOPTERA.

Fam. CALOPTERYGIDAE.

1. **Neurobasis chinensis florida** HAGEN (121), SELYS (93, 120), HAGEN (43), RIS (86), FRASER (31, sub *chinensis*).

Locally common throughout the year along slowly or fast running streams and rivers from near sea-level (south-coast!) up to ca. 1300 meters alt. Chiefly a lowland species preferring open sunny places, and always restricted to the grassy borders of the water, flying close to its surface. Their curious fluttering flight is very suggestive of the skippers (*Hesperiidae*) among the butterflies, and the magnificently emerald-green hind wings make this striking species very conspicuous. When in flight the flatly spread hind wings act as planes whilst the fore serve to propel the insect as it skims the surface of a stream. Settles on drift-wood and grass blades close to the water-mark.

The ♀ is always accompanied by the ♂ during oviposition, which takes place in submersed roots and grass stems. This was observed in a stream near Soekanegara. The pair was sitting on a floating stem and both individuals walked slowly backwards, descending down the stem under water, until the ♀ was completely submerged and the ♂ partly so, holding its wings parallel to the water's surface. The ♀ remained under water for a very long time. The slender larva hides obstinately among submersed grass, twigs and rootlets near the river-bank.

The subspecies has a scattered distribution; it occurs in India and is also known from Borneo in a slightly modified form, but replaced by *chinensis* in Ceylon, Further India, Malaya and Sumatra.

West Java: Malimping, sea-level (I) Buitenzorg; Mt. Salak; Tjipeundeuj near Djasinga; Soekaboemi; Mt. Halimoen; Mt. Tjisoeroe, Djampang Tengah; Tjisolok; Wijnkoops Bay; Zand Bay (III) Radjamandala; Bandoeng; Mt. Tangkoeban Prahoe; Tjikaso River near Tjipitjoeng (IV).

Mid Java: Mt. Slamat, Batoerraden (VII) Mt. Merbaboe (VIII).

East Java: Mt. Wilis (XVI) Mt. Kawi (XVIII).

2. **Vestalis luctuosa** (BURM., 9) SELYS (93, 121) RIS (86).

Found commonly all the year round along brooks and streams in shaded localities. It frequents small forest-brooks in mountain districts to a height of 2000 m, and, though less commonly, breeds also in small streamlets almost at the level of the sea, seeking the cool shady places where the vegetation is rankest. Oviposits in the soft tissue of rank herbage at water-mark, or in submersed stems of *Commelinaceae*. The species occurs everywhere in Java and flies often in company with *Euphaea variegata* and *Rhinocypha fenestrata*. A detailed description with figures of the half-grown larva is found in RIS's paper. The ultimate larval instar was found by me under débris in small mountain brooks.

I have seen several examples of *luctuosa* from the Lampong district west of Telokbetong in South Sumatra (Wai Lima and Talang Padang country), where it flies in company with — and possibly outnumbers — the black *V. lugens* SELYS, which is quite common north of the watershed of the Sekampoeng River (Ranau distr.) and distributed throughout Central Sumatra. Otherwise not found outside Java.

Fam. EUPHAEIDAE.

3. **Euphaea variegata** (RAMBUR, 82), SELYS (93, 95, 121), RIS (86), KONINGSBERGER (50).

A common woodland species, distributed all over the island among mountain brooks as well as on small rivers with swiftly flowing water, from the sea-coast upwards to 1300 m. The males are frisky, sun-loving creatures. In flight they are often seen going through characteristic manoeuverings, which are unrivalled. Two males are necessary for the performance. They fly up from some stone in the stream-bed with rapidly fluttering wings, rising into the air in a face-to-face dance, one a few inches in front of the other, when suddenly one will rise and pass over the other, which at the same time moves in a curve downwards and then upwards, while the other drops, swinging itself gracefully backwards and upwards so that the former position of the two is just the same as before. These motions kept up with rapidity and regularity give the observer the impression of two glittering circles of sparkling emerald and topaz which move in a perpetual up and down in the sunshine. The ♀♀ of this beautiful insect are often met with at some distance from the water, and owing to their uncoloured wings, are easily overlooked. The eggs are placed in rows within the soft tissue of all kinds of aquatic plants.

In July, 1934, I observed a solitary ♀ ovipositing in a hard, bark-bared piece of wood, stuck up between two boulders in a torrential stream near Tjisompet (Priangan). After alighting on the outstanding portion of the substratum, it descended down below the surface of the roaring water, walking slowly backwards until the body was completely submerged. The *Euphaea*, then, was well visible by its wings which appeared as if silver-plated, owing to their being surrounded by a complete film of air. The dragonfly felt about with its styles until a suitable place was found and then everted the terebra in the usual way, making an incision with the sharp points of the anterior processes in which the egg was placed. The whole body was then moved a short distance downwards and the act repeated on a new spot. The process was very slow but our insect did not show any trepidation when it was touched by hand; it remained under water for a quarter of an hour before it was captured, and an examination of the piece of wood showed that only seven irregularly placed holes had been made, five of them containing a single egg.

A general account and many figures of the curious larva was published by RIS (86). It is my hope to describe the eggs and the first larval stages of *Euphaea* in a separate memoir to be published elsewhere. They are found

lurking among leafy débris at the bottom of pools in the course of a small stream.

East Javan *variegata* differ in no way from western specimens.

I have seen large series of typical *variegata* from the S.W. part of the Lampong district in South Sumatra, from whence I have also received specimens of *E. aspasia* SELYS. Although Sumatran *variegata* are on an average smaller than West Javan individuals, the extension of the green patch on the hind wing of the male is variable to some extent in both series, this spot touching the hind margin of the wing in the majority of Sumatran specimens from Wai Lima an Mt. Tanggamoes. On the other hand, in a large series taken by myself on Mt. Salak, certain individuals have their wings rather narrower than usual, the green spot on the hind wings being also reduced in size. KRÜGER's subspec. *intermedia*, from Sumatra, thus appears not to have any significance.

4. **Dysphaea dimidiata** SELYS (93, 95, 96, 116, 121).

Since the time of its description, some eighty years ago, this species has not been found anywhere in Java and I have not seen any authentic specimens other than the typical series. It must be either extremely local or very rare. The original locality is merely given as 'Java', and only a few specimens, all ♂♂, have come to our knowledge. Typical specimens have been recorded from Sumatra, and a slightly modified form occurs in Malaya and Borneo. A thorough revision of the genus is urgently needed.

According to FRASER, the Indian representatives breed in swift submontane and montane streams. Mr. COOMANS DE RUITER, who has collected in West Borneo, writes me that both the variety *limbata* SEL. of *dimidiata* and *D. lugens* SEL., inhabit small streams in low country, the males being fond of settling on the dead branches of trees which have fallen into the water. In such inaccessible situations they often remain motionless for a long time, holding their wings closed over the back. The ♀♀ are only rarely seen.

Fam. LIBELLAGINIDAE.

5. **Rhinocypha anisoptera** SELYS (96), RIS (86).

Hitherto only found in East Java and very likely confined to that part of the island. Like the other members of the genus a forest-haunting species restricted to brooks and mountain streams with heavy stones in the bed. Found throughout the year and very abundant locally from 500 to ca. 2200 m. Its occurrence in several districts of Sumatra and complete absence in West Java is of particular interest.

East Java: Mt. Wilis (XVI) Mt. Welirang; Mt. Ardjoeno; Mt. Kawi, 1000 m; Nongkodjadjar, 1200 m (XVIII) Mt. Tengger; Mt. Semeroe (XIX) Idjen Plateau, 950 m; Mt. Raoeng, Bajoekidoel, 500 m (XX).

6. **Rhinocypha fenestrata** (BURM., 9) SELYS (93, 121) RIS (86) FRASER (31).

Very common everywhere in suitable places, especially so in the western districts of the island, from near sea-level (south-coast!) up to about 1000 m.

Apparantly also fairly common in Mid and East Java from whence only few localities are known to me.

FRASER has described the peculiar habits and flight of *Rhinocypha* as follows: "When mating, the males perform a kind of nuptial dance before the female, during which they make a great display of the white pulverulent flexor surface of the hinder pairs of tibiae. The legs are trailed and show up dazzlingly white in the strong sunshine. Meanwhile the forewings flutter rapidly to support the insect, whilst that the hinder pair are held flat to display their wealth of colour. The ♀, perched on a prominent twig beside the stream, appears to be totally unconcerned by its mate's efforts to attract her. One very rarely sees a pair *in cop.*, although vast numbers of both sexes may be present on the banks of the stream". These habits can be studied almost on every forest-stream.

West Java: Common.

Mid Java: Isle Noesa Kambangan, sea-level, common; Mt. Slamat, Batoerraden, 850 m, common; Djeroeklegi & Koebangkangkoeng, sea-level (VII) Ambarawa (IX).

East Java: Mt. Kawi; Mt. Ardjoeno; Malang; Mt Tengger (XVIII).

7. **Rhinocypha heterostigma** (RAMB., 82) SELYS (93) FRASER (31).

Confined to the mountain districts of West and Mid Java. Common along small rocky streams, often in company with *fenestrata* in submontane regions, solitarily at higher levels. Not found below 600 m and becoming increasingly common up to an altitude of 1300 m, but does not appear to rise above 1600 m in any part of the island. As in *fenestrata*, I have records of it from every month of the year and there appears a continuous succession of broods.

The extension of the dark wing colour is subject to considerable variation in both sexes; this variability is independent of the localities and apparently not caused by seasonal influences. In 1928 I have examined RAMBUR's type-specimens, a very mutilated pair in the Brussels Museum. Contrary to SELYS' statement, the female of RAMBUR is still in existence.

West Java: Mt. Salak, Goenoeng Boender, 800 m; Mt. Megamendoeng, 800 m; Mt. Gedeh, Tapos 800 m, Tjiboenar 1000 m and Tjibodas 14-1600 m; Mt. Halimoen and Mt. Tjisoeroe, Djampang Tengah, 500-600 m; Soekaboemi; Soekanegara, 700-900 m (III) Radjamandala, 500 m; Mt. Tangkoeban Prahoe, 1500 m; Mt. Goentoer, Kamodjang, 1400 m; Mt. Limboeng and adjacent mountains, 700-1000 m; Pengalengan (IV).

Mid Java: Mt. Slamat, Batoerraden, 850 m, common (VII).

Erroneously recorded by FRASER (31) from South Sumatra. The species is confined to Java.

8. **Rhinocypha selysi** KRÜGER (51).

A very rare species. New to Java.

West Java: 4 ♂♂, Mt. Halimoen, ca. 500 m, July-Aug. 1927, native coll. (III). Previously only known from Sumatra, from whence I have seen

examples of both sexes from different localities. The Javan specimens have the dark wing markings more extensive than those from Central and South Sumatra, but in this respect the species is a variable insect. Possibly a series from Mt. Tjisoeroe, Djampang Tengah, taken along with *R. heterostigma*, belongs also to *selysi*.

9. **Libellago lineata lineata** (BURM., 9) (SELYS, 93, 94, 121) (KRÜGER, 51) (WILLIAMSON, 126) (RIS, 86) FRASER (31) LIEFTINCK (70).

A moderately common insect occurring throughout the year in sago-marshes, among slowly running brooklets and, generally, along the banks of various streamlets and rivers in low country, sometimes forming large colonies. Though of very small size, the yellow and black bodied males are conspicuous insects, sharply contrasting with the dark surface of the water. Habits and flight quite similar to *Rhinocypha*. I have often observed the oviposition in pieces of driftwood and floating twigs along the banks of a river. Although widely distributed, the species shows a predilection for certain waters and therefore is not often noticed. The larva of Indian *lineata* was described by FRASER (24, 34).

West Java: Pasaoeran; Malimping (I) Depok; Tjiseëng; Tjileungsi; Tjiampea; Buitenzorg; Tjigombong, 500 m; Mt. Pantjar, 500 m; Tjisolok; Wijnkoops Bay; Mt. Tjisoeroe, Djampang Tengah, 600 m; Lake Njalindoeng, 900 m (III) Radjamandala, 350 m, Tjitaroem River (IV).

Mid Java: Patimoean and Djeroeklegi, south-coast (VII) Toentang and Samarang (IX).

10. **Libellago sumatrana** (SELYS, 96) LIEFTINCK (70).

A very rare species. Hitherto only known from the sunny streams near Pasaoeran in the extreme western part of Bantam residency, where seven ♂♂ and one ♀ were taken by the writer on May 23, 1931. It was flying in company with *lineata* at the rivers Tjilampir, Tjsoenkoei and Tjitjaloeng, but while the latter occurred in great abundance, *sumatrana* was very scarce. A single ♂ was recently captured by me in a sago-marsh near Malimping, south Bantam, April 24, 1933.

Fam. LESTIDAE.

11. **Lestes concinnus** SELYS (104).

This species has originally been described from a pair taken near Batavia. Considerable doubt has arisen whether the pale coloured specimens from China and the Philippine Islands might belong to the same species, the result of which was HAGEN's proposal to consider the olive-green and black Batavia insects distinct from the sandy-brown specimens from other countries, the former being named *amata* (HAGEN i.l.) SELYS, the latter *concinna* SELYS. I have discussed the matter with the late Dr. RIS and pointed out to him that in Java both forms occur together and that structural differences are entirely absent, so that the two forms evidently belong to one and the same species.

Both Dr. RIS and the writer were misled by the striking differences in colour but recent captures of Mr. DRESCHER in South Java have confirmed my later supposition that *amata* merely is the final melanotic colour-stage of *concinnus*. After making careful comparisons with specimens of medium age I am now convinced that *'amata'* cannot claim specific rank. The very slowly advancing process of maturity is well known among *Lestidae*, and *concinnus* is a striking example of this gradual development of colours.

L. concinnus is a plain species, restricted to the coastal zone. Emergence takes place simultaneously, mostly in immense numbers. The teneral imagoes form very localized colonies, living at first in marshes, the adults being found amongst dry grass, sometimes far away from their breeding-place. The Tjilatjap specimens were taken from May to August in swamps containing slightly brackish water. Those from Noesa Kambangan, Patimoean and Djeroeklegi are fresh water insects, showing all colour-phases from uniform sandy brown to olive-green and black, and apparently are on the wing during the whole year. The extremes of both forms are strikingly different in general appearance. About 80 males and 50 females have been examined by the author.

West Java: Pasaoeran, coastal swamp (I) Batavia (II) Buitenzorg (III).

Mid Java: Patimoean; Djeroeklegi; Tjilatjap; isle Noesa Kambangan (VII) Samarang, teak forest (IX) Gedangan, hill-country in teak forest; Tjolo, Mt. Moerjo, 300 m (XII).

East Java: Padangan, teak forest (XV) Soerabaia (XVII).

In the Leiden Museum is a single ♂ (typical *'amata'*) from the island Madoera, off the N.E. coast of Java, collected by C. J. A. STEEN.

L. umbrinus (SELYS), from Burma &c is no doubt the same species.

12. **Lestes praemorsus praemorsus** (SELYS, 104).

Not hitherto reported from Java. Probably widely distributed but apparently a rare species. Ranges from India to the Bismarck Archipelago and presumably forms local races for the definition of which an abundant supply of material from all its settlements is required. When at rest, this insect holds its wings half expanded, with the abdomen slightly drooped but strongly curved upwards at tip: a very peculiar attitude. The few males captured by me in the Botanic Garden flew round the border of a *Lotus* pond. Although the same pond has afterwards thoroughly been inspected whenever possible, no further specimens were secured. LAIDLAW, who collected this species near Kuala Aring, Malay States, quotes from his diary: "Aug. 20, 1899: I found to-day large numbers of a species of Dragonfly over a pond; I caught several pairs. Aug. 28, 1899: I noticed that the species which I had seen so abundantly near the pond had disappeared almost entirely. I have only found it in this one spot" (56).

The Malimping specimen in our collection was taken in a long-abandoned paddy-field with a rich vegetation and surrounded by shrubs with overhanging foliage. A description and figures of the larva (from Boeroe) have been published in one of the writer's earlier papers (67).

West Java: One ♂, Malimping, April 24, 1933, AUTHOR; one ♂, Klappers Is. (Poeloe Deli) off the S.W. coast, Febr. 17, 1932, native coll. (I). Four ♂♂, Buitenzorg, Sept. 29, 1929, AUTHOR (III).

13. **Platylestes heterostylus** LIEFTINCK (71).

Known only from a single ♂ specimen, taken by Mr. DRESCHER among bushes in a swampy place near Djeroeklegi (South Banjoemas) in Mid Java, on Jan. 28, 1931. It has the habits of a *Lestes* and rests with the wings half open. *P. platystylus* (RAMB.) from Bengal and Burma is the second species known and, like *heterostylus*, one of the rarest *Zygoptera* found in southern Asia. The early stages are unknown.

Fam. MEGAPODAGRIONIDAE.

14. **Rhinagrion tricolor** (KRÜGER, 51).

Of this fine and very rare insect I have seen only a single male collected by M. C. PIEPERS on Mt. Tengger in East Java, without any further indication of habitat (Mus. Leiden). KRÜGER's description is based upon two males and one female, labelled 'Java', in the Stettin Museum. No further specimens are known. The members of this genus breed in small streams and are very locally distributed, occasionally forming small colonies.

I have found an unpublished memorandum concerning *Rh. mima* in the late Prof. FÖRSTER's hand-copy of KIRBY's Catalogue, where he remarks: "*A. mima* von Hochmalaka, im Gebirge an Baumstämmen". This points to a curious habit that should be traced further. Early stages unknown.

Fam. PLATYSTICTIDAE.

15. **Drepanosticta gazella** LIEFTINCK (66).

Small colonies of this tiny species occur in the forests of probably most of the mountains in West and Mid Java at altitudes from 500 to 1500 m. Especially to be looked for in ravines among bushes and wet rocks overhanging brooks, or in very damp jungle where a seepage finds its way down through ferns and mosses to the rocky bed of some stream. Found during the whole year.

FRASER's interesting account on the habitats of Indian *Platysticta*, a genus closely allied to *Drepanosticta*, is well worthy of quotation. They occur "......in submontane and montane tracts, rarely at sea-level. They are found haunting the banks of mountain streams of small size, often a mere trickle over rocks or a chain of pools below a spring on a steep jungly hillside in dense shade. In flight they hover with the long attenuated abdomen held stiffly and horizontally out, whilst the insect advances or retires in a series of short jerky movements. Owing to their dull colouring, small size and dark surroundings they are remarkably inconspicuous" (38). These remarks are without reserve also applicable to Javan *Drepanosticta*.

West Java: Mt. Karang, Pasirangin, 600 m (I) Mt. Pantjar, 500 m; Mt. Salak, Goenoeng Boender, 600 m; Mt. Gedeh-Panggerango, Sitoe Goenoeng, 1000 m and Tjisaroewa, 1000 m; Mt. Megamendoeng, 800 m; Poentjak pass, 1500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m; Soekanegara, 700 m (III) Mt. Limboeng, 900 m (IV).

Mid Java: Mt. Slamat, Batoerraden, 8-900 m (VII).

16. **Drepanosticta siebersi** FRASER (31) LIEFTINCK (66).

Known only from a very mutilated pair in the Buitenzorg Museum, collected somewhere in the Tengger Mts., at about 1700 m alt. (XVIII, East Java). The precise locality and the name of the collector are unknown.

17. **Drepanosticta spatulifera** LIEFTINCK (66).

Discovered in 1927 by Mr. DRESCHER in the forests near Batoerraden, on the slope of Mt. Slamat (VII, Mid Java). Only twelve males and fourteen females were captured during five years in succession and in all months of the year. Evidently a very scarce species. No other localities have come to our knowledge.

18. **Drepanosticta sundana** (KRÜGER, 51) (RIS, 86) LIEFTINCK (66).

Widely but sparingly distributed throughout the island, from sea-level up to ca. 900 m alt. Habits similar to the other species but less restricted to heavy jungle and often occurring in more open places such as bamboo groves and second growth woods. The Tjarita specimen had just emerged from a tiny brook flowing through flat country near the sea-coast. Breeds also in rapid streams, the larva crawling to large stones along the edge of the water. A full description and figures of the aberrant type of larva is found in this Journal, 14, 1934.

West Java: Tjarita, sea-level; Mt. Karang, Pasirangan, 600 m (I) Mt. Salak, Waroeng Loa and Goenoeng Boender, 5-800 m; Bolang, near Leuwiliang, 600 m; Mt. Pantjar, 500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III) Mt. Limboeng, 900 m; Tjipitjoeng, 300 m (IV).

Mid Java: Isle Noesa Kambangan, sea-level; Mt. Slamat, Batoerraden, 850 m (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

Fam. AGRIONIDAE.

Subfam. Protoneurinae.

19. **Caconeura autumnalis** FRASER (27, 38) LIEFTINCK (68, sub *corvina*).

Originally described from Shillong, Assam and since then also reported from Burma and Tonkin. FRASER has correctly placed *corvina* m. as a synonym of this species. Apparently a wide-ranging insect and quite common at low levels, occurring throughout the year in Java. Breeds in woodland rivers and small brooks, also in cultivated areas. Owing to its retiring habits and black

colouring, *autumnalis* is a most inconspicuous and easily overlooked species. Ranges from sea-level up to 600 m alt.

In the Botanic Garden of Buitenzorg it breeds in a small sluggish stream flowing in a mud bed through woods. At many places clumps of bamboo grow on the immediate banks, and below the mass of tough fibrous roots which form a vertical bank are frequently pools of deeper water. *Autumnalis* flies in the shadow of these masses of roots, or hovers for many minutes over the black water so that a hurried collector might have passed up and down the stream without detecting the presence of this slender blackish insect. The ♀ oviposits in submersed rootlets of lianas, hanging down into the water, and is held by the ♂ during oviposition.

Occurs also plentifully in the forests of the Karimoen Djawa Islands, breeding in small leaf-bottomed brooks in shady surroundings.

In outward appearance and structure of caudal gills the larva resembles much the common type found in the *Agrionidae*.

West Java: Pasaoeran, sea-level, common along running water; Tjikoetjang, near Tjamara, sea-level; Malimping, streams in low country (I) Buitenzorg; Mt. Pantjar, 500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m; Tjisolok, small forest-streams in low country; Wijnkoops Bay, do. (III) Radjamandala, Tjitaroem river, 350 m (IV).

Mid Java: Djeroeklegi and Koebangkangkoeng, plain level (VII) Karimoen Djawa Is. (Java Sea) (XII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

20. **Caconeura delicatula** Lieftinck (68).

Also a plain species, but very rare. Decidedly more restricted to virgin country than *autumnalis*, hiding up in dense shade on the banks of rocky streams and in deep ravines where overhanging trees and shrubs produce a perpetual twilight. Apparently to be found throughout the year but always in very limited numbers. Like *autumnalis*, this species in shade is all but invisible on the wing, but as the males come out in the sunlight, hovering almost motionless near the water's surface, the bright orange thoracic spots suddenly appear like tiny flames to attract the attention of the collector. The larva is still unknown.

West Java: One ♂, Tjimataram between Pasaoeran and Tjarita, in dense forest, May 22, 1931, Author; one ♂, Bajah, 80 m (south-coast), Sept. 1934, M. E. Walsh (I) One ♂, Mt. Pantjar, 500 m, Dec. 11, 1931, in shady sago-marsh, Author (III).

Mid Java: Numerous specimens, isle Noesa Kambangan, virgin forest, all the year round; Djeroeklegi and Koebangkangkoeng, low country, locally common throughout the year, Drescher and Toxopeus (VII).

21. **Caconeura humeralis** (Selys, 103) (Förster, 22) (Ris, 86) Lieftinck (68).

A single male from Moela on Mt. Sewoe, 150 m alt., has been described

and figured by RIS (86). This is the only dragonfly caught in the XIth residency, a country that might yield many other species of interest.

C. humeralis is evidently the same species as that reported from Java by FÖRSTER (22) as *Disparoneura verticalis delia* (KARSCH). I have not seen myself any authentic Javan example.

22. **Notoneura insignis** (SELYS, 115) (KRÜGER, 51) (RIS, 86) (FRASER, 31) (LIEFTINCK, 68).

Through the kindness of M. A. BALL, I have recently been able to examine the long-lost type of *insignis*, a single male from Sumatra in the Brussels Museum, and this has now proved to be the same as *fruhstorferi* (KRÜGER *et auct.*). I hope to comment again upon this and allied *Notoneura* at some other place. The type of *fruhstorferi* (male only) was described from 'Java'.

Widely but sparingly distributed over the whole island. Lives in similar places as *C. delicatula* but occurs from near sea-level up to a height of ca. 1000 m, being most commonly seen in submontane regions. Frequently found in company with *Coeliccia membranipes* and *Drepanosticta gazella* and *sundana*, throughout the year.

W e s t J a v a: Pasaoeran, sea-level, in woody retreats; Bajah, south-coast, 80 m; Mt. Karang, Pasirangin, Pagerbatoe, Djoehoel, 300-700 m (I) Bolang, near Leuwiliang, 600 m; Tjipeundeuj, near Djasinga, 800 m; Mt. Pantjar, 500 m; Mt. Halimoen and Mt. Tjisoeroe, 5-600 m; Tjisolok and Wijnkoops Bay, plain forests (III) Radjamandala, 350 m; Bantarpeundeuj, between Pameungpeuk and Tjisompet, 200-500 m, common on small forest streams (IV).

M i d J a v a: Djeroeklegi and isle Noesa Kambangan, common; Mt. Slamat, Batoerraden, 850 m (VII).

E a s t J a v a: Idjen Plateau, Blawan, 950 m; Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

Subfam. P l a t y c n e m i n a e.

23. **Coeliccia lieftincki** LAIDLAW (63) RIS (86).

A rare woodland species, occurring sparsely throughout West and Mid Java, especially along small brooklets forming a network in swampy forest clad with *Araceae* and *Zingiberaceae*, not above 900 m. A shade-loving species. Apparently rather common all the year round on Noesa Kambangan and also not rare, though very local, at higher altitudes on Mt. Slamat, quite frequently in company with *C. membranipes*. The single imperfect ♂ from Noesa Kambangan, identified by RIS as *membranipes* and now in the Leiden Museum, belongs to this species (86).

W e s t J a v a: Bolang, near Leuwiliang, 600 m; Tjipeundeuj, near Djasinga, 800 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III).

M i d J a v a: Koebangkangkoeng; Djeroeklegi; Tjilatjap; isle Noesa Kambangan (all in plain country); Mt. Slamat, Batoerraden, 850 m (VII).

24. **Coeliccia membranipes membranipes** (RAMB., 82) SELYS (105, 115) KRÜGER (51) RIS (86, 91).

A forest-dwelling species, widely and commonly distributed over the island and occurring throughout the year in moisty places from near sea-level up to 1800 m. Breeds in pools at the edge of swift streams but also in the shallow and slowly running waters of forest marshes, and never wandering far from these places. It is most commonly come across in submontane regions, restricted to damp jungle in low country. The ♀ is accompanied 'per collum' by the ♂ during oviposition. This takes place in the soft tissue of submersed *Commelinaceae* and other semi-aquatic plants. The larva is not easily noticed and is well concealed among rotten leaves on the bottom of some pool; when disturbed it may be seen moving stealthily over the dark bottom until it clings to a leaf-stalk or twig on which it is practically invisible. At times the adult rests with the wings half open.

25. **Copera annulata** (SELYS, 105).

Very rare. Not so far reported from Java. The two specimens mentioned below were seen along the borders of a weedy brooklet flowing through high grass and sedges, near the entrance of the lake. Known also from South Sumatra but not yet found in Borneo. According to FRASER, the *annulata* group breed in ponds and lakes, whereas the members of the *marginipes* group are typically stream-dwelling species.

West Java: One ♂, one ♀, Rawah Danoe, May 25, 1931, AUTHOR (I).

26. **Copera marginipes** (RAMB., 82) SELYS (105, 115) KRÜGER (51) RIS (86) KONINGSBERGER (50).

A plain species, found everywhere amongst undergrowth along slowly running water. Very common throughout the year in second growth woods, rubber plantations and sago-marshes. In Java this species breeds also in ponds, and I have observed the oviposition in *Utricularia*. In the Botanic Garden of Buitenzorg I found the larvae hiding among the silt assembled between the fine aerial rootlets of lianas pending freely into the water of a stream. The so-called "ghost" forms are tenerals usually of a pure white or spotted with black, and are very conspicuous as they steal with jerky movements through the dark undergrowth (see also FRASER, 28). Probably the highest recorded altitude at which this insect has been taken is ca. 900 m, near Soekanegara (III).

Subfam. Agrioninae.

27. **Onychargia atrocyana** SELYS (106) HAGEN (44, sub *vittigera*).

Only reported from 'Java' by DE SELYS. A rare species though evidently widely distributed, also in Java. FRASER's interesting information on Indian specimens is very likely also applicable to Malaysian insects:— "Whilst great numbers of tenerals are continually seen emerging, the adult insect is com-

paratively rarely come across, except when actually pairing. I believe this to be due to the fact that the adult retires to the shelter of trees on which I have occasionally seen them at a great height from the ground, a very rare habitat among Coenagrionines" (28).

The two specimens from Goenoengsari were found far from water, hiding among shrubbery along the roadside. Breeds in tanks and marshes.

West Java: One pair, not fully adult, Goenoengsari near Rawah Danoe, May 25, 1931, AUTHOR (I).

Mid Java: Patimoean and Koebangkangkoeng, marshy woodland, near the coast, numerous specimens, Jan. to May, and November, DRESCHER and TOXOPEUS (VII).

28. **Ceriagrion annulosum** LIEFTINCK (74).

Described from a single male, collected by FRUHSTORFER somewhere in the island. Quite recently, I have received a second male specimen from Dr. TOXOPEUS, captured by him in the Lampong districts in South Sumatra (Giesting, 500 m, Sept. 29, 1933). This example is smaller than the type, measuring: abd. 34, hw. 22.5 mm. Quite distinct from other species by the black apical rings encircling segm. 3 to 6 of abdomen; from *C. pallidum* FRASER (37), which also has blackish rings, it differs by the grass-green and yellow body, and by the knob-like upper anal apps. Evidently a rare species.

29. **Ceriagrion cerinorubellum** (BRAUER, 2).

New to Java. A permanent colony has established itself in a virgin forest-swamp between Tjiteureup and Tjileungsi, ca. 20 km north of Buitenzorg, in plain country. This marsh is entirely isolated, lying amidst cultivated land; it is full of boggy spots and is traversed by numerous small trickles and brooks about which is an abundant growth of the rare tree *Elaeocarpus littoralis* T. & B. and gigantic arums (*Cyrtosperma merkusii* (HASSK.)), with other lush vegetation. *Cerinorubellum* is extremely abundant in this forest, occurring especially about the boggy spots, resting on larger leaved plants and flying low and through brush to escape. The female oviposits in submersed leaves, preferably in *Utricularia* and is held 'per collum' by the male during the act of oviposition. It is a very conspicuous and swiftly flying insect, found all the year round in the same locality. The beautiful combination of colours will serve to its easy recognition.

Probably not rare but very local a species in Java. So far, Tjileungsi is the only locality known for this species.

30. **Ceriagrion coromandelianum** (FABR., 16).

New to Java. Rather stouter and larger than *erubescens*, and apparently fairly commonly spread over the swampy districts of Southwest and South Java. Chiefly a lowland species, often breeding in slightly brackish waters, but also found in submontane areas, flying among the reeds of tanks and ponds.

The conspicuously grass-green and citron-yellow males are swiftly flying and very rapacious insects, whereas the duller females are more often come across solitarily in scrub jungle or in plantations, often far from water. Once, in Oct. 1930, Mr. DRESCHER took scores of specimens, many *in cop.,* in dry hilly country near Djeroeklegi; the males of this series have a brick red abdomen, a grass-green thorax and the eyes dark blue. In Jan. 1931, similar individuals were found in copulation among rice-fields, at some distance of the previous locality. Quite a common species in South Banjoemas. In the Botanic Garden of Buitenzorg I once saw a male caught by a specimen of *Brachythemis contaminata.*

West Java: Pasaoeran; Malimping (I) Buitenzorg; Mt. Pantjar, 500 m; Mt. Gedeh, Tjibodas, 1400 m (III) Radjamandala, 350 m; Mt. Tangkoeban Prahoe, 1500 m; Mt. Papandajan, 1700 m (IV).

Mid Java: Babakan, Djeroeklegi and Patimoean, sea-level (VII) Telawa, near Djetès (XII).

31. **Ceriagrion erubescens** SELYS (117).

Also new to Java. This fine carmine red insect is very rare in Java, being found only in the sunny coastal swamps near Djeroeklegi (VII), where four ♂♂ could be taken by Mr. DRESCHER, on Jan. 12 and Oct. 19, 1929. Possibly widely distributed in similar situations, but undoubtedly much scarcer than its robust congener *coromandelianum.*

32. **Ceriagrion praetermissum** LIEFTINCK (66) RIS (86) FRASER (38).

Described from a pair in the Leiden Museum, collected by M. C. PIEPERS in 'Java'. This is the smallest species of *Ceriagrion* known. It is essentially restricted to large marshes and lakes where the surface of the water is concealed by extensive carpetings of *Pistia stratiotes* or other floating plants, such as *Eichhornia, Limnanthemum* &c. Here the species may be found in the greatest abundance, threading their way in jerks among the leaves. During oviposition, which takes place in the fine submersed roots of these plants, the ♀ is inseparably accompanied by the ♂. Though of much smaller size, the larva is very similar to that of *C. coromandelianum,* living well concealed among the thread-like rootlets of *Eichhornia* and *Pistia*-rozettes.

West Java: Rawah Danoe, May 25, 1931, very common, AUTHOR (I). Lake Tjigombong, 500 m, March 16, Sept. 1, 1930, and March 29, 1931, common, AUTHOR (III).

Mid Java: Djocja, Febr. 1911, one ♀ taken by JACOBSON (XI); recorded by RIS sub *erubescens.*

A fine series of both sexes was recently captured by Dr. TOXOPEUS near Talangpadang (Lampong distr.) in South Sumatra, July 1934.

33. **Pseudagrion bengalense** LAIDLAW (57).

Not previously reported from Java. Occurs very sparingly in West and Mid Java from the sea-coast upwards to rather high levels (highest recorded altitude:

marshes on Mt. Patoeha, ca. 1700 m). Breeds in weedy ponds and lakes with a rich submerse vegetation among which the larva hides. Not uncommon during the whole year in the Botanic Garden of Buitenzorg, but always far outnumbered by *P. microcephalum,* with which it is often mixed. Occasionally also breeding in lagoons containing slightly brackish water. A swift-flying insect, more robustly built and clearer coloured than *microcephalum.*

West Java: Tandjoeng Poetjoet, brackish water (I) Tjitajam; Tjileungsi; Tjiomas; Buitenzorg; Tjigombong; Soekanegara; Lake Njalindoeng, 900 m, very common; Sitoe Goenoeng, 1000 m (III) Bandoeng; Mt. Patoeha (IV).

Mid Java: Djeroeklegi and Patimoean, sea-level (VII).

34. **Pseudagrion infracavum** SCHMIDT [1]).

This is another blue and black species, which, according to Dr. SCHMIDT (*in litt.*), is most nearly allied to *P. nigrofasciatum* LIEFT. Discovered on Lake Lamongan (XIX), East Java, by the German Limnological Expedition 1928-'29. Not seen by me.

35. **Pseudagrion microcephalum** (RAMB., 82) SELYS (107) DAMMERMAN (13).

Very common throughout the year in similar situations as *P. bengalense,* breeding also in sluggish streams and narrow irrigation channels, widely distributed in flat country and often found in brackish water marshes in the coastal districts. The highest altitude at which this insect has been taken in Java is 1400 m, ponds in the mountain garden of Tjibodas (Mt. Gedeh). The most eastern locality known to me is Ambarawa (IX), but there is hardly any doubt that it is also well distributed in East Java.

I have seen large series from Bali and almost all other islands of the Archipelago. DAMMERMAN collected a single full-grown larva from the brackish water pool on Verlaten Island, in April, 1920. This insect was provisionally identified by Col. FRASER as "*P. pruinosum?* SEL." Recently, the adult was also found in this locality.

36. **Pseudagrion nigrofasciatum** LIEFTINCK (74).

Described from two ♂♂, one ♀ collected by HEKMEIJER in East Java (possibly on Mt. Ardjoeno?) (XVIII). Not yet found elsewhere. This species is allied to *P. bengalense* and *infracavum.*

37. **Pseudagrion pruinosum pruinosum** (BURM., 9) SELYS (107) CALVERT (10).

The original diagnosis of this species is based upon a single ♂ from Java, collected by DE HAAN. Afterwards, a very full description of both sexes was given by DE SELYS, drawn up from material sent to him by PLOEM, also from Java but without further indication. As has been pointed out by CALVERT, SELYS does not seem to have examined BURMEISTER's type, which possibly is not the

[1]) This species will soon be described in „Tropische Binnengewässer", Bd. V (Arch. Hydrobiol. Suppl.-Bd. XIII).

same as *pruinosum* auct. As, however, the identification of the type is impossible, I prefer to consider BURMEISTER to be the creator of this species.

A fairly common woodland insect, breeding in small streams usually containing slowly running water. Found throughout the year from near sea-level upwards to about 1500 m. *P. pruinosum* prefers shady surroundings, sometimes occurring quite abundantly in such places, keeping well out and low over the water's surface and often hovering for long periods over one spot. The larva is pale in colour and is found among submersed grass and roots near the border of a stream. I have seen but few specimens from East Java (Mt. Kawi, XVIII).

Although a small series from Mt. Tanggamoes (southern extremity of Sumatra) does not seem to present any differences with the Javan type, specimens from other regions (e.g. from E. Borneo) probably represent distinct subspecies.

38. **Pseudagrion rubriceps** SELYS (107).

Less frequently met with and less numerous than *microcephalum*, but evidently widely spread and common on muddy streams, irrigation channels and tiny water courses among rice-fields, frequenting those with a rich growth of aquatic vegetation. Chiefly breeding in running waters but also in ponds and woody marshes. As in the allied species of the genus, oviposition takes place in the tissue of leaves and stems of all kinds of plants, the female being always accompanied 'per collum' by the male during this act. In a small stream at Tjiampea, many pairs of *rubriceps* were observed depositing their eggs in submersed leaves of *Blyxa* which were lying flush with the water's surface, swept by the current but firmly anchored by their stems. The larva is wholly transparent green. I have seen males of this species hovering over trickles in mangrove swamps and slow running streams very near the coast. Highest recorded altitude about 1000 m.

West Java: Pasaoeran (I) Tandjoeng Priok; Antjol; Batavia (II) Tjiseëng; Tjibinoeng; Depok; Tjileungsi; Buitenzorg; Tjiomas; Tjiampea; Tjigombong; Tjisolok (near the Wijnkoops Bay) (III) Radjamandala; Bandoeng; Mt. Tangkoeban Prahoe (IV).

Mid Java: Djeroeklegi, sea-level; Koebangkangkoeng (VII).

East Java: Malang (XVIII).

39. **Archibasis melanocyana** (SELYS, 108).

New to Java. Two males, captured along trickles in dense scrub jungle near Koebangkangkoeng (South Banjoemas, Mid Java), Febr. 8 to 14, 1932 by Mr. DRESCHER, are the only individuals known from the island. During a two weeks' sojourn in the Karimoen Djawa Islands (Java Sea), in November 1930, I found large colonies of this species along the banks of small shady forest-brooks; with *Caconeura autumnalis* it was the only Zygopterid breeding in these places and no single *Pseudagrion* was found. The female is attended by the male during oviposition, the eggs being inserted in rows within the soft bark

of fine whitewashed roots of overhanging trees. The same species was again come across in the inaccessible coast swamps to the east of P. Karimoen, where *Mortonagrion falcatum* was discovered. It is a widely distributed species throughout Malaysia.

40. **Teinobasis euglena** LIEFTINCK (74).

This very slender Agrionid was discovered almost simultaneously in the swampy scrub forest of the Kinderzee district (S. Banjoemas) and in a forest-marsh near Telok Betong (southern extremity of Sumatra). It is essentially an inhabitant of the virgin forest swamps in the lowlands of South Java, where cultivation has not yet obtained a foothold. As in so many other *Teinobasis*, this species varies much in colouring, the teneral stage being entirely unlike the adult insect.

M i d J a v a: Djeroeklegi; Patimoean; Koebangkangkoeng (VII). Large series, all collected by Mr. DRESCHER, from Dec. to July, 1930-'33; frequently met with in the wet season months Jan., Febr. and March. A single male was found also by DRESCHER at light in Tjilatjap (VII), Dec. 10, 1930.

41. **Pericnemis stictica** SELYS (105, 108) KRÜGER (51) RIS (91).

Originally described from 'Java'. A rather rare species, decidedly restricted to primeval or second growth forests, sparingly distributed over the whole island and in all months of the year. In several places *P. stictica* shows a marked predilection for dark shady surroundings, such as bamboo groves and in the neighbourhood of small streams and marshes on steep heavily wooded hillsides or in ravines. Although very local it is usually rather common in such places, forming definite and lasting colonies, restricted to small areas. Hitherto observed from sea-level up to about 900 m. The flight is weak and the insects cover only short distances.

The larva is still unknown but should it be discovered, it will probably prove to be similar to that of *Pseudagrion*, *Teinobasis* or *Archibasis*. It will be a matter of great interest to ascertain, by future observations, if the excessively long abdomen of the adult is a special adaptation to the life of their offspring in water-containing plants, such as *Bromeliaceae*, or if the attenuated body is correlated with peculiarities in length in the plants or other objects (stumps of old bamboo, tree-holes?) in which they possibly oviposit [1]).

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[1]) Lately, it has been my good fortune to obtain further evidence of this species living in water gathered in axils of plants and similar habitats. While collecting *Mecoptera* and other insects in a shady forest on the western slope of Mt. Bèsèr, near Tjiandjoer (III), ca. 1200 m alt., on Sept. 30, 1934, our attention was directed to a number of bamboo stools of giant size, which grow abundantly along the trail leading to the summit of this mountain. Some of the heavier bamboo-stems had been cut down by natives between the internodia, about three ft. above the ground, and many of the open tubes thus formed had allowed rain-water to accumulate in them. The majority of these water-filled bamboo-trunks were tenanted, in addition to the predacious mosquito-larvae of the genus *Megarhinus* and other *Culicidae*, by the curious tailed larvae of Cyphonid beetles, larvae and pupae of *Tipula pedata* (WIED.), and a large Syrphid larva. To my great surprise, in a nearly dried up hole, I found 4 whole and entire wings of a large zygopterous dragonfly which soon proved to be of an adult ♀ of

P. stictica is the largest Zygopteron of the Malay Archipelago. It is also known from Sumatra and Borneo, but I doubt whether specimens from these islands figuring under this name really belong to *stictica*. *P. triangularis* Laidlaw, from N. Borneo, is certainly distinct.

West Java: Mt. Karang, Pasirangin, 600 m (I) Depok, 100 m; Mt. Pantjar, 500 m; Mt. Halimoen and Mt. Tjisoeroe, Djampang Tengah, 5-600 m; Soekaboemi, 600 m; Leuwimangoe, 600 m; Tjisolok and Wijnkoops Bay, sea-level (III).

Mid Java: Isle Noesa Kambangan, plain forest; Mt. Slamat, Batoerraden, 850 m (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

42. **Argiocnemis rubescens** Selys (108) Lieftinck (73).

Recorded from Java by de Selys only. Although sparingly distributed, this species is abundant during most of the year along the borders of certain mountain lakes surrounded by virgin forest, and in marshes or ponds in similar situations in West and Mid Java at altitudes from 800-1500 m. Much rarer in coastal districts and always restricted to clear stagnant or slowly running waters in wooded country. Not so far discovered in the eastern part of the island. As is well known, this and allied species pass through fine red teneral stages which are entirely unlike the adult insect.

West Java: Mt. Gedeh, Poentjak pass: Telagawarna, 1480 m; Tjiboenar and Sitoe Goenoeng, 1000 m; Soekaboemi; Lake Njalindoeng, 900 m; Soekanegara, 900 m; Leuwimangoe, 600 m (III) Mt. Tangkoeban Prahoe, 1500 m; Mt. Goentoer, Kamodjang, 1450 m; Pameungpeuk-Tjisompet, forests up to 900 m (IV).

Mid Java: Djeroeklegi and isle Noesa Kambangan, low forest (VII).

Pericnemis stictica (pterost. white!). In the hour we remained after these wings were found, a number of other trunks were carefully examined, but no larvae were found and not a single grown dragonfly was observed here. On our way home we noticed only one specimen in the scrub-jungle, about two miles away from the original spot. Since, as stated above, the adults of *Pericnemis* frequently abide in bamboo-groves and often occur there in numbers, it is virtually certain that the usual living conditions of this insect were satisfied here or in similar situations.

As has been observed by Calvert (Ent. News, 22, 1911: 402-411), the nymphs of other long-bodied Zygoptera, such as the neotropic *Mecistogaster modestus* Selys, have exclusively plant-dwelling habits, living between the water-containing leaves of epiphytic *Bromeliaceae*. Of this species, Calvert justly remarks: "... if *Mecistogaster*'s eggs are deposited in the plant tissue in or near the contained water, in accordance with the general habit of Zygoptera, it would often be necessary for the female to reach far down into crevices possibly too narrow to admit of the entrance of her thorax and abdomen. The long abdomen with the ovipositor near its hind end would therefore be of distinct advantage..." (*l.c.* p. 410). Possibly, the ♀ of *P. stictica* whose wings were left in the bamboo-tube, was drowned during her attempts to escape, after or before depositing her eggs. It is evident that there still remains much to be done in exactly defining the conditions under which the early stages of *Pericnemis* are found. It may be noted here that Thienemann, in "Die Tierwelt der tropischen Pflanzengewässer" (Arch. Hydrobiol. Suppl. 13, 5, 1934: 31) mentions one Agrionid- and one Libellulid larva, both undetermined, found by him in „Bambustöpfe im Urwald", in South Sumatra.

43. **Xiphiagrion cyanomelas** SELYS (107) LIEFTINCK (66).

First described from Java by the author. Hitherto only found on the Idjen Plateau in East Java, and in the barren fields between the Kawah Domas and Kawah Djarian, two of the smaller but active craters of Mt. Tangkoeban Prahoe, in West Java. In the latter locality, the tiny blue and black *Xiphiagrion* occur along a small unsheltered brook meandering through these grounds. This streamlet is devoid of aquatic vegetation except algae, and contains tepid or hot sulphurous water, the temperature of which varies according to the depth of the water and the distance from its origin. Perhaps over 50 meters of its course *Xiphiagrion* abounds, hovering over the water or perched on overhanging twigs, and, when disturbed, keeps well out of the way, hiding up among dry scrub and boulders near the ground. The larvae are also found in the greatest abundance here, crawling and swimming freely around on the bottom of the stream where they are easily detected. At the time of our visits, the part of the streamlet in which *Xiphiagrion* breeds, had a temperature of about 42 °C. Numerous specimens were taken, mostly by Mr. DRESCHER, during ten months of the year, there being in all probability a continuous succession of broods. *X. cyanomelas* has a wide and scattered distribution, ranging from Simaloer Is. (off the W. coast of Sumatra) to the Bismarck Archipelago but has not as yet been reported from the mainland of Sumatra or Borneo. I have seen large series from Flores, Celebes and New Guinea, which probably represent an equal number of definable geographical races.

West Java: Mt. Tangkoeban Prahoe, 1450 m, crater-brooks (IV).

East Java: Idjen Plateau, Blawan, 950 m, Oct. to Dec., 1933, LUCHT (XX).

44. **Ischnura aurora** BRAUER (2).

New to Java. On this tiny red and azure-blue *Ischnura* FRASER writes: — "One of those insects which has made full use of the upper air currents, crossing seemingly impossible barriers of land and ocean" (38). Distributed all over the oriental region without forming geographical races. Very rare in Java but extremely abundant, probably the whole year round, in three localities at high altitude. On Mt. Patoeha (IV, West Java) it is quite common along the borders of the crater-lake Telaga Patengan, ca. 1600 m alt., visited by Mr. DRESCHER and Miss JUTTING in the dry season months April, May and June. Further, large colonies have established themselves among the lakes Tjebong, Warna, Dringoe, Merdada and Pengilon, on the Diëng Plateau (VIII, Mid Java) at an elevation of ca. 21-2200 m, where the insect was discovered in August 1930 by Miss JUTTING, and commonly met with again by Mr. F. DUPONT in August 1934. In this place it flies in company with *I. senegalensis*. Lastly, Prof. HANDSCHIN took large series on the borders of the mountain-lake Ranoe Pani in the Tengger Mts., Febr. 1931, at an altitude of 2100 meters (XVIII, East Java). The larva is quite similar to that of *I. senegalensis*.

Erroneously recorded from "Malaysia, the Sondaic Archipelago, Borneo" by FRASER (38, sub *delicata* HAG.).

45. **Ischnura senegalensis** (RAMB., 82) SELYS (107) RIS (86) DAMMERMAN (13).

This is by far the commonest species of *Agrionidae* in Java. It dominates almost everywhere, especially in cultivated areas, and is universally distributed from sea-level to over 3000 m, breeding in all stagnant waters. Found also in very lonely places, such as the windy grass-fields on the summit of the higher mountains, where even the shallowest marsh is sufficient to keep it up.

The author took specimens on three small and completely dry islets off the N. W. coast of Java, viz. Hoorn, Enkhuizen and Dapoer, to which it was evidently blown by wind. DAMMERMAN collected both larvae and imagoes in the Krakatau group of islands. Occurs plentifully on the islands Bawean and Karimoen Djawa (Java Sea). Highest recorded altitudes: Mt. Panggerango, 3015 m, and Mt. Papandajan, 2350 m. Breeds also in oligohaline waters.

46. **Agriocnemis femina** (BRAUER, 6a) SELYS (108) KRÜGER (51) KONINGSBERGER (50) RIS (89) LIEFTINCK (72a).

One of the commonest of oriental Odonata and almost universally distributed. Found everywhere in Java at all altitudes up to about 1600 m. Breeds in lakes and shallow marshes, sluggish streams and ponds, occasionally also abundantly in brackish water swamps. *A. femina* is a common dragonfly in the cultivated region and one of the most important elements of the fauna of rice-fields (s a w a h), destroying throughout its development myriads of midges and other injurious insects occurring in these places. KONINGSBERGER is wrong in considering *Copera marginipes* and *A. incisa* SEL. (= *femina*) to be chiefly forest-dwelling insects since both species are decidedly more abundant in cultivated areas. Both have a wide distribution, *A. femina* ranging from the Seychelles to Australia. The adult ♂ with its dark head and black eyes and with its thorax overled with a snowy white pruinescence, in spite of its small size is a very conspicuous insect. DAMMERMAN found a few specimens on Sebesi, one of the islands north of the volcanic Krakatau group (April, 1921).

47. **Agriocnemis minima** SELYS (108) LIEFTINCK (68).

Originally described from a single ♂ collected in 'Java'. Few other specimens, captured by DRESCHER in South Java, have been discussed in the writer's paper, cited above. Since then I have come across this species near Buitenzorg, and in Bantam, while TOXOPEUS found it again in a coastal swamp in the same district. Apparently a scarce insect throughout West Java in flat country, but although easily escaping notice extremely abundant in suitable places. It occurs plentifully in the vast and inaccessable swamps of Rawah Danoe, living particularly in such places where the surface of the water is concealed by carpetings of *Pistia* and *Eichhornia*. When in flight it hugs the water's surface closely, stealing along in short jerky flights, usually resting on grass and leaves

hardly an inch above the water and therefore exceedingly difficult to take without wetting one's net. On the Danoe lake the tiny *A. minima* flies in company with *Ceriagrion praetermissum*, which is also a very common insect there. Also very abundant in the virgin forest-marsh near Tjileungsi, where I took large series in all seasons of the year and observed the oviposition in floating plots of *Utricularia*. The specimens from Tjarita came to a powerful carbid lantern-trap in the camp near the beach and probably originated from the marshes nearby.

West Java: Numerous specimens (♀ of the red and green colour-form) Rawa Danoe, May 25, 1931, AUTHOR; 3 ♂♂, one ♀, Tjarita, Oct. 4, 1930, TOXOPEUS (I) Tjileungsi, near Buitenzorg, forest-marsh, common (III).

Mid Java: Patimoean and Koebangkangkoeng, low country, common in Febr. and March, DRESCHER and TOXOPEUS (VII).

The species is confined to Java.

48. **Agriocnemis pygmaea** SELYS (108) (?RAMB., 82) HAGEN (40) RIS (86).

Ranges from India to Australia. Although less abundant than *femina*, this is also a very common insect found everywhere in Java in similar situations as *femina* and often flying in company with it. Highest recorded altitude 1700 m. Also known from the Karimoen Djawa and Bawean islands in the Java Sea (DAMMERMAN and LIEFTINCK), and occasionally observed along the beach in South Java. The males of this species are very rarely powdered with white on the back of their thorax.

49. **Mortonagrion falcatum** LIEFTINCK (74).

Not yet found in Java but doubtlessly occurring in the island. Described from a series of both sexes, captured by myself in the Karimoen Djawa archipelago, Nov. 25 to 29, 1930. This is a group of small islands in the Java Sea, lying slightly east of the centre point of the north coast of Java and about 38 miles from it.

Our species was found only in the coastal zone, keeping low to the surface of the water in well concealed deep pools, in the mangrove scrub.

Oviposition was not observed and no nymph which could belong to this species was found. For details of flight and habitats see the author's previous paper.

50. **Aciagrion aciculare** LIEFTINCK (66, 74).

The writer's description was based upon few specimens collected near Batavia by JACOBSON. Since then I have come across this tiny insect in various other localities in West Java. It is chiefly a plain species and a very common damselfly on some of the weedy ponds in the Botanic Garden of Buitenzorg, where it occurs throughout the year, swarming round the grassy borders and hunting close to the water's surface. Oviposition takes place in the leaves or stems of *Nymphaeaceae, Limnanthemum, Hydrilla* and various other plants.

Once, they were so numerous and so busily engaged with this action that I counted more than a dozen of couples crowded together on a single *Nymphaea* leaf. The species is especially abundant here during the first two or three weeks following on a long period of heavy rainfall, usually in the wet season months January and February. When freshly emerged, the teneral imagoes immediately leave the border of the pond, fluttering high up and straight on to the sheltering trees and shrubbery at some distance of the breeding place and hiding up there until the colours are fully developed. Once I took a few specimens in a damp situation in the virgin forest of Tjisaroea (Mt. Gedeh, ca. 1000 m.), but this is an exceptionally high altitude for this insect.

West Java: Batavia (II) Depok; Tjiseëng; Tjileungsi; Tjiampea; Buitenzorg; Bolang, near Leuwiliang, 600 m; Mt. Gedeh, Tjisaroea Est., 1000 m (III).

Mid Java: Djeroeklegi, plain country (VII).

51. **Aciagrion fasciculare** Lieftinck (74).

This tiny and inconspicuous insect was first discovered by the author in two or three shallow weedy marshes at the foot of densely forested hills, near Soekanegara, in West Java, about 900 m alt. It was commonly found there by Toxopeus and myself, in Dec., March and April. On lake Njalindoeng, some 20 km west of Soekanegara, this species is excessively abundant, frequenting the grassy shore-vegetation and hiding among the herbage in shady places. The oviposition takes place in decaying twigs and grass-stems, close to the water's surface, in most instances the female being held 'per collum' by the male during this act. The larva is much alike that of *Ischnura* and was found in the same place. Like *A. aciculare*, tenerals immediately leave the border of the lake after emergence, flying into scrub-jungle and trees, occasionally far away from the water.

Easily distinguished from *aciculare* by its purplish coloration. Females are dark green instead of purple. Evidently a very local species.

West Java: Lake Njalindoeng, 900 m, June and July, Author; Soekanegara, 900 m, Toxopeus and Author (III).

52. **Enallagma malayanum** Selys (107).

Described from a single ♂ specimen, collected in 'Java'. Re-discovered by Mr. Drescher who took a male in a railway-compartment between Gombong and the tunnel Idjoe, in the plains of south Banjoemas (VII). This very rare species, which does not seem to have ever been found on the neighbouring islands, might still have a wide distribution in Java as well as in Sumatra.

On a hurried visit to the beautiful littoral districts of South Banjoemas, the writer spent a few hours' collecting in the lagoons and marshes behind the beach near Babakan, with the object of finding this species again. I managed to secure eight males in a brackish water lagoon, just behind the beach, by wading to my middle into the tepid water. It was very easily mistaken for

Pseudagrion microcephalum, flying exclusively over open water and "sculling" the surface closely; the males were fond of resting flat on floating plots of *Enteromorpha,* but were so shy as to be almost unapproachable. The species was far outnumbered by the *Pseudagrion,* but on looking out well could be distinguished by their slightly smaller size and deeper blue colouring. The female was not seen over the water. Early stages unknown.

Mid Java: One ♂, Gombong, May 9, 1930, DRESCHER; eight ♂♂, Babakan, sea-level, March 28, 1933, AUTHOR (VII).

Sub-ordo ANISOPTERA.

Fam. **LIBELLULIDAE.**

Subfam. Libellulinae.

53. **Tetrathemis irregularis hyalina** (KIRBY, 48) KRÜGER (54) RIS (84).

Rare. Breeds in sunny forest-pools and marshes, usually in company with *Agrionoptera insignis* and allied genera. The adults perch on dead twigs of overhanging trees and owing to their cryptic colouring are difficult to detect among the foliage. Copulation was observed by DRESCHER in the months March, April and October. Early stages unknown.

West Java: Rawah Danoe, forest swamp, May 25, 1931, AUTHOR (I) Tjisolok, Wijnkoops Bay, forest pool, April 15, 1933, AUTHOR (III).

Mid Java: Plain country near Djeroeklegi, Febr. to April, and October; Koebangkangkoeng, Jan. to May and Oct. to November, DRESCHER (VII).

54. **Tetrathemis platyptera** SELYS (112) KRÜGER (54) RIS (84).

Recorded by RIS from South Java where FRUHSTORFER took five ♂♂ and one ♀. KRÜGER also appears to have seen a few specimens. These are the only individuals known from the island. It has a wide distribution outside our faunal limits.

FRASER has given interesting information on the egg-laying habits of this species: "In Coorg the act was performed well above water, the eggs being inserted into moss and lichen growing on a stump which was sticking up from the surface of the water. The females with their abdomen curled well under the body, hovered in front of the stump, darting in and out, stabbing their eggs into the moss at about two feet above water level. Owing to their smallness, the yellow colour of the body and saffronation of their wings, I first mistook them for wasps hovering round the stump" (28).

55. **Orchithemis pulcherrima** (BRAUER, 8) SELYS (112) RIS (84).

Species of this genus inhabit forest swamps and large marshes at low altitude, preferring sunny glades in the middle of dense jungle, where the blue and black or fiery red males rest on leaves and twigs with their wings sloping downward. Only a single male specimen of the dark stage has previously been recorded from Java by RIS. It was collected in 'Java' by PLOEM.

O. pulcherrima is a rare and very local species. I found it literally swarming in the damp virgin jungle around Rawah Danoe but did not meet with it again in the surrounding marsh or on the lake itself. All stages of maturity were found flying together on the same day, the very conspicuous adults being predominate on that occasion over the red teneral form. The only other finding-place in Java known to me is the isolated forest marsh near Tjileungsi, where a rich colony is settled. Flight weak and "hovering", covering short distances. I found numbers of exuviae, attached to leaf-stalks of grasses and *Commelinaceae*, close to the water's surface.

West Java: Rawah Danoe, May 25, 1931, very common, Author (I) Tjileungsi, plain forest, common all the year round, Author (III).

56. **Lyriothemis cleis** (Brauer, 6, 7) Ris (84).

Only a single ♂ and three ♀♀ were hitherto known from 'Java', without further indication of habitat. Rare and evidently a very local species, arborial in its habits and seldom found far from the shelters of deep jungle, breeding in pools and marshes with clear water. Nothing, however, is known of its early stages.

West Java: Mt. Tjisoeroe, Djampang Tengah, 600 m, 1932, native coll. (III).

Mid Java: Three ♂♂, isle Noesa Kambangan, plain forest, Aug. 31, 1927, June 4 and Aug. 6, 1932, Drescher (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, Oct. 1931, Lucht (XX).

57. **Lyriothemis magnificata** (Selys, 112) Ris (84).

Previously known only from a single ♀ in Martin's collection, labelled 'Java'. Also a forest-dwelling species, quite unknown from the western part of the island but apparently rather common in a few places of the southern provinces, flying in company with the former species. It is particularly interesting to note that, on Noesa Kambangan, specimens of this fine insect are on the wing during most of the year, and this might be explained by the great rainfall and humidity of this island even in the driest period of the east monsoon, enabling many aquatic insects to produce a continuous succession of broods. In East Java practically all shallow stagnant waters dry up rapidly at the end of the west monsoon, so that dragonflies then soon disappear. Life-history unknown.

Mid Java: Five ♂♂, four ♀♀ taken in dense jungle on Noesa Kambangan, Aug. 31, 1927, April 22 and June 13, 1928, Nov. 15, 1929, June 9 and Oct. 4-11, 1930, Aug. 6, 1932 and Febr. 19, 1933, all taken by Drescher; three ♀♀, Koebangkangkoeng, dense forest, Febr. 8-14, 1932, Drescher (VII).

East Java: Slopes of Mt. Raoeng, Bajoekidoel Est., 500 m, Jan. 1932, Lucht (XX).

58. **Agrionoptera insignis insignis** (RAMB., 82) RIS (84, 86) DAMMERMAN (13).

Originally described from Java. This species is entirely restricted to the littoral zone of Java, found abundantly throughout the year in mangrove-swamps, among pools in woody retreats near the sea-shore, or in the overflown scrub-wildernesses near the mouth of muddy streams. Quite unknown from the interior of Java. Breeds in almost all stagnant waters but, like the following species, is a forest loving insect preferring small shady pools. Numbers of males may be seen resting on the tips of projecting branches or dead twigs but owing to their dark blood-red and black colour-pattern are easily overlooked. Unlike *Lathrecista* it has the habit of hovering for long periods over the dark water, being motionlessly suspended in the air and fancying itself so well protected that it can be swept up with the greatest of ease. Oviposition was observed on various occasions and takes place in the usual way, the female being unattended by the male. I once observed two males resting on a twig some five feet above the surface of the water, anxiously watching the process of egg-laying until one of them got a chance of seizing its partner again.

A. insignis is one of the commonest, and certainly the most striking of all dragonflies inhabiting the islands of the Krakatau group; it was discovered by JACOBSON on Krakatau itself as early as 1908 (RIS, 86), and since then has been observed by subsequent visitors on Sebesi and Verlaten Island as well. It is also extremely abundant in the Karimoen Djawa group of islands (Java Sea), breeding freely in fresh-water tanks or pools, and in the mangrove-scrub.

West Java: Krakatau, Sebesi and Verlaten Is., JACOBSON and DAMMERMAN (Strait Soenda); Klappers Island (P. Deli), off the S.W. point of Java, Febr. 17-24, 1932, native coll.; Pasaoeran, mangrove-swamp, May 23, 1931, AUTHOR (I) Tjipanas near Tjisolok, April 15, 1933, common, AUTHOR; Wijnkoops Bay, Jan. 18, 1934, common, AUTHOR (III).

Mid Java: Babakan, Aug. 1927 and March 1933, DRESCHER and AUTHOR; isle Noesa Kambangan, not uncommon in Jan., Febr., April, Aug. and Dec., DRESCHER (VII) Karimoen Djawa Islands, May 1926 and Nov. 1930, very abundant, DAMMERMAN and AUTHOR (XII).

East Java: Banjoewangi, Sept. 25, 1932, along the beach, TOXOPEUS (XX).

59. **Lathrecista asiatica asiatica** (FABR., 18).

New to Java. A rather rare species with a wide distribution outside Java, occasionally found along the banks of slow running rivers in low country, yet only where jungle clothes the banks. Apparently more commonly spread in littoral districts and sometimes quite abundant in swampy woods near the coast in South Java. A shy and retiring insect but easily recognized by its light red abdomen. Usually found in company with *Agrionoptera insignis* and *Potamarcha obscura,* and with habits similar to the former. Breeds in pools and forest marshes, perhaps also in brackish water. The handsomely coloured

males are on the wing during most of the year. Females are rare and inconspicuous; only three examples are known to me, one from Buitenzorg and two from the Wijnkoops Bay and Babakan.

West Java: Pasaoeran, riverine, May 23, 1931, AUTHOR (I) Buitenzorg, Aug. and Sept. 1919, one pair determined by FRASER as *L.a. pectoralis* BRAUER; Depok, Oct. 1907, EDW. JACOBSON; Wijnkoops Bay, common in Dec. 1933 and Jan. 1934, AUTHOR (III).

Mid Java: One pair, Babakan, sea-level, Aug. 1927 and March 1933, DRESCHER and AUTHOR; Djeroeklegi, common, Febr. 1-28, 1931, DRESCHER; isle Noesa Kambangan, scarce, Dec. 1927 and May 5, 1930, DRESCHER (VII) One ♂, Kemiri, March 1916, W. ROEPKE (XII).

60. **Potamarcha obscura** (RAMB., 82) (HAGEN, 39) KARSCH (45) (SELYS, 113) KRÜGER (54) RIS (84).

One of the commonest Libellulines of the island. Occurs everywhere and in all seasons. Highest recorded altitudes Mt. Tangkoeban Prahoe, 1600 m and Kamodjang, near Garoet, 1450 m. It is extremely abundant in plain country and is more often found in cultivated than in forested areas. The insects may be observed swarming over muddy pools and round the borders of irrigating ditches, the turbid drinking places of buffalos being a favourite haunt. They prey upon all kinds of insects, especially syrphus- and dung-flies being noticed among these.

Unlike *Agrionoptera* this species wanders far from water and is particularly fond of settling on telephone wires. On auto-trips across the cultivated country of West Java hardly any such wire can be seen along the road during the ride that does not hold thousands of occupants. *Potamarcha* is also a very common species in the littoral zone and numerous specimens may be observed in the low bush behind the beach in South Java. Breeds in all stagnant and slowly running waters, also where the water is slightly brackish. The oviposition is accomplished without the male's attendance and the larva lives in the mud of pools, rice-fields and marshes. Both sexes are attracted by light at dusk. I possess a ♂ collected by DELSMAN, in June 1920, on Bawean Is. (Java Sea) and Mr. VAN DELDEN caught a ♀ on Kangean Is., in April 1932. Both specimens are true to typical *obscura*.

61. **Cratilla lineata** (BRAUER, 8) RIS (84).

Recorded from 'Java' and Buitenzorg by RIS.

A rather rare woodland species with a wide distribution in Java, occurring from near the sea-shore upwards to altitudes varying between 600 and 850 meters. A very local dragonfly, only exceptionally found in great numbers in one locality, preferring shady leaf-bottomed forest pools. In its habits *C. lineata* has much in common with *Potamarcha obscura* with which I have always found it associated. Though larger, it is at first easily mistaken for it, yet *Cratilla* is a much warier insect. The dark males perch on the ends of prominent branches

and twigs with their body held straight out and with wings sloping strongly downward; they dart up on the slightest move but usually soon come back to the same spot as before.

On a visit to the forest marshes at the foot of immense limestone rocks, immediately joining on to the beach of the Wijnkoops Bay, on Jan. 18, 1934, I met with a great abundance of Libelluline dragonflies, among which all four of the *Potamarcha* series of genera were represented, viz. *Agrionoptera, Lathrecista, Potamarcha* and *Cratilla,* the latter being the scarcest among them. A single ♂, collected by DOCTERS VAN LEEUWEN on Krakatau Is., 1925, differs very markedly from Javan specimens by its dark colours. In this respect it is identical to the race occurring in South Sumatra and Borneo, of which I have seen several examples. Local races of *lineata* will very probably prove distinguishable.

As in *Potamarcha* and *Orthetrum,* the larva lies up in the mud or among dead leaves on the bottom of small pools.

W e s t J a v a: One ♂, Malimping, sea-level, April 24, 1933, AUTHOR (I) Three ♂♂, Bolang near Leuwiliang, ca. 800 m, forest pool, July 26, 1931, AUTHOR; two ♂♂, Tjipeundeuj, near Djasinga, 800 m, July 22, 1934, AUTHOR; one ♂, Buitenzorg, Aug. 1919, determined by FRASER as *P. obscura* RB.; one pair, Mt. Tjisoeroe, Djampang Tengah, 650 m, March and May, 1933, native coll.; one ♂, Wijnkoops Bay, Jan. 18, 1934, AUTHOR (III) Two ♂♂, one ♀, Radjamandala, 350 m, March 27, 1934, forest pool, TOXOPEUS (IV).

M i d J a v a: Mt. Slamat, Batoerraden, 850 m, locally fairly common throughout the year, DRESCHER (VII).

62. **Cratilla metallica** (BRAUER, 8) SELYS (116) RIS (84).

Reported from 'Java' by DE SELYS without further comments; cited by RIS.

I have examined a single damaged male in the collection of the Amsterdam Museum, labelled: *"Orthemis Wallacii* SELYS, ♂ var. Java", in ALBARDA's handwriting. The species should be rediscovered sooner or later.

Ranges from Burma and Cambodia throughout Malaysia and is locally common in forest-marshes. I have seen specimens from the extreme southern point of Sumatra, Banka and Borneo.

63. **Orthetrum chrysis** SELYS (117).

New to Java. Chiefly a plain species, widely but sparingly distributed all over the island in woody districts, breeding in leaf-bottomed forest pools, marshes and small brooks. Moderately common, but local, at low altitudes; much rarer in submontane areas where it is replaced by *O. pruinosum.* The glorious red males prefer open sunny places near the water's edge, resting on the prominent twigs of faggots, or on stones beside their breeding place. A very shy and active species, easily recognized on the wing from *O. testaceum* by the head and thorax being darker and by the vividness of its crimson abdomen. On Mt. Tangkoeban Prahoe and in various other localities these two species fly together, and in such places the females are practically indistinguishable.

During my stay in the Karimoen Djawa archipelago (Nov. 1930), *O. chrysis* was met with in the greatest abundance, disporting over clear forest brooks. Copulation was often observed there and is accomplished in flight; it lasts many minutes, and during the act of oviposition the female remains incessantly accompanied by the male. Sometimes, when the ♀ is about to oviposit, the ♂ releases its partner, alights on a twig close by and defends her carefully against competitors, attacking boldly any passing dragonfly. The larvae were found under débris and leaves in pools.

West Java: Rawah Danoe, fairly common along brooks in the marsh, May 25, 1931, AUTHOR; Malimping, April 24, 1933, common, AUTHOR (I) Tjileungsi, common in the forest during most of the year, AUTHOR; Tjipeundeuj, near Djasinga, July, AUTHOR; Tjisolok, April and June, and Wijnkoops Bay, Jan., AUTHOR; Zand Bay, July, DOCTERS VAN LEEUWEN; Soekanegara; Pagelaran; Leuwimangoe, Dec. 1931, AUTHOR (III) Radjamandala, Sept. 23, 1931, AUTHOR; Mt. Tangkoeban Prahoe, 14-1500 m, Sept., Oct., Febr., December, common with *O. testaceum* and *pruinosum*, DRESCHER (IV).

Mid Java: Djeroeklegi, sea-level, April 14, 1929 and Jan. 20, 1931, DRESCHER (VII) Karimoen Djawa Is., Java Sea, AUTHOR (XII).

64. **Orthetrum glaucum** (BRAUER, 1) RIS (84).

First recorded from 'Java' by RIS. Moderately common. Distributed throughout the island in all months of the year, occurring from sea-level up to about 1400 m. Breeds in streams or in brooks flowing through marshes and very often the males are seen hawking up and down roadside brooks. Oviposition was observed here or in pebbly shallows of the stream, the ♀ being unaccompanied by the ♂. The species is readily distinguished from its congeners by the uncrossed triangle of the hind wing and by the bright blue pruinescence of its abdomen. In aged females the body is sometimes also densely powdered with blue.

West Java: Pasaoeran, riverine; Tjikoetjang near Tjemara; Malimping; Bajah, south-coast (I) Mt. Gedeh, Tjiboenar Est.; Soekaboemi; Mt. Halimoen and Mt. Tjisoeroe, Djampang Tengah; Soekanegara; Pagelaran; Leuwimangoe; Tanggeung; Tjisolok; Wijnkoops Bay (III) Mt. Tangkoeban Prahoe; Mt. Limboeng near Tjisompet (IV).

Mid Java: Mt. Slamat, Batoerraden; Djeroeklegi (VII).

East Java: Mt. Lawoe, Sarangan (XIV) Popoh, beach (XVI) Mt. Raoeng, Bajoekidoel Est. (XX).

65. **Orthetrum luzonicum** (BRAUER, 6 and 7) RIS (84).

A mountain species, not yet found below 700 m. Rare, but apparently widely distributed and forming isolated colonies in certain districts at high elevation. Breeds in marshes and lakes with an abundant growth of cat- and horse-tails, a stream flowing through a marsh being a favourite spot. The adult is easily captured, except on hot days; it flies over short distances, hovering for long

periods in the air and settles on scrub or reed-stems. Oviposition takes place solitarily or 'per collum', in most cases the ♀ being attended by the ♂. Copulation was observed in March, Aug. and Dec. The larvae have gregarious habits, lying up in the mud or among curtains of algae. In Telaga Saät all larval stages are represented the whole year round.

West Java: Mt. Gedeh, Tjibodas and Telaga Saät, Poentjak pass, 14-1500 m, common in marshes, AUTHOR; Wanasari above Soekaboemi, 1300 m, July, W. ROEPKE; Mt. Tjisoeroe, Djampang Tengah, 600 m, July, native coll.; Soekanegara and Leuwimangoe, 900-700 m, fairly common in marshes, March, Oct. and Dec., TOXOPEUS and AUTHOR (III) Mt. Patoeha, Telaga Patengan, 1600 m, Nov., W. ROEPKE; Pengalengan Plateau, Tjitere, 1400 m, July, J. VAN DER VECHT (IV).

Mid Java: Diëng Plateau, 18-2100 m, very common in August along small brooks and in marshes, T. VAN BENTHEM JUTTING and F. DUPONT (VIII).

66. **Orthetrum pruinosum pruinosum** (BURM., 9) (BRAUER, 2) SELYS (112) RIS (83, 84) KONINGSBERGER (50).

Originally described from Java. A very common species all the year round and distributed over the entire island. Restricted to mountainous regions. It was recorded by RIS from Batavia, Buitenzorg and Soerabaia, but at such low altitudes it is seldom come across in abundance and usually replaced by *O. testaceum,* which is a common insect in low country. It occurs very sparingly in the Botanic Garden of Buitenzorg, and I have seen only few specimens from altitudes below 500 meters above the sea. The purplish red males are very conspicuous insects on the wing; they are often seen patrolling sunny forest-paths, roadside brooks and pools, mostly in large numbers. Frequently found in shallow marshes and among leaf-bottomed ponds in wooded country, where from some twig or stone they watch the traffic, attacking all passing animals. A bold and swift-flying insect.

The ♀ prefers sheltered retreats, going only to the water to oviposit, while the active ♂♂ constantly patrol the shore on the lookout for females or for their insect prey. Immediately after each copulation the ♀ proceeds to ovipositing which is accomplished without the male's attendance. The larvae are found in similar situations as *O. chrysis.*

67. **Orthetrum sabina** (DRURY, 15) NEEDHAM (81) RIS (84, 86) KONINGSBERGER (50).

Extremely abundant throughout the whole of Java. One of the best known and most easily recognized dragonflies of Java and a dominant species in cultivated country, breeding in all stagnant and slowly running waters. Owing to its insensibility to changes in temperature and rainfall, it can stand in almost any country, from sea-level up to about 2500 m.

Unlike other members of the genus it frequents rank herbage round the borders of ponds, lakes and rivers, darting stealthily about among grasses and

harmonising well with its surroundings. It feeds principally on microlepidoptera, bugs and zygopterous dragonflies, and, as Fraser justly remarks, "is a veritable shark amongst these small defenceless insects" (28). In the coppice around the forest-marsh near Tjileungsi, I once observed considerably numbers of *sabina* being in pursuit of the large bluish white Flatid *Bythopsyrna tineoides* Oliv., which mimics a Lycaenid on the wing (March 26, 1934).

O. sabina flies swiftly over short stretches, but quite unlike other *Orthetra* is mostly seen resting in long grass or among leaves in the shrubby undergrowth. The copulation was often observed in the grass round the water's edge; it lasts from 68 seconds to over 5 minutes and each act of copulation may take place with a different male. The eggs are laid singly, although sometimes the ♂ retains his hold of the prothorax of the ♀. Breeds also in brackish waters. I have seen or captured myself specimens on the arid coral-islets Onrust, Enkhuizen and Hoorn, off the northcoast of Java, and Messrs Delsman and Dammerman took it on Bawean Is., in the Java Sea. During my stay in the Karimoen Djawa archipelago only few individuals of *sabina* were observed. The larva has been described and figured by Needham, from specimens collected in Buitenzorg.

68. **Orthetrum silvarum** Lieftinck (75).

Described from a series of males, taken by myself near a forest-pool on the northern slope of Mt. Gedeh-Panggerango, June 5-16, 1932 (III, West Java). A shade-loving species, probably confined to forest-marshes at high elevations. Owing to its cryptic colouring, *silvarum* is a remarkably inconspicuous insect; it has the habit of resting on leaves among dense foliage, and, accordingly, is easily overlooked. The female is still unknown.

69. **Orthetrum testaceum testaceum** (Burm., 9) Kirby (49) Ris (84) Koningsberger (50).

The type comes from Java. This is chiefly a lowland species, universally and commonly distributed all over the island, breeding in almost any waters. Habits similar to *O. chrysis* and, although often found in company with this species, less selective with regard to its haunts. *O. testaceum* becomes increasingly rare as traced higher in the mountains, the highest recorded altitude lying at about 1500 meters above sea-level.

When on the wing the ♂ is distinguished from *chrysis* by its lightly coloured head and by the orange-red of the body being less intensive. No intermediate examples have ever come under my notice.

70. **Orthetrum triangulare triangulare** Selys (112).

New to Java. Of this species, I have lately received four adult males, captured by a native hunter in April 1933, and May 1934, on Mt. Tjisoeroe at ca. 600 m above sea-level (Djampang Tengah, III, West Java). Evidently a very rare species in Java.

Ranges from India through Malaya to Sumatra, whence it has first been recorded by RIS, in 1927. Previously not known elsewhere. The discovery of this species so far south is of great zoogeographical interest.

In Western India, according to FRASER, *O. triangulare* is a mountain species with palaearctic tendencies, found at altitudes above 5000 ft. Its lower line of distribution meets, but rarely merges with that of *O. glaucum*, although their habits and breeding-places are identical. They appear to be inimical to one another and FRASER does not ever remember seeing the two species in the same locality.

71. **Brachydiplax chalybea chalybea** (BRAUER, 6).

Not so far reported from Java. Not common but apparently widely distributed in non-cultivated wooded country, and essentially restricted to the plains. Moderately common in the coastal districts of West and South Java, breeding in ponds, marshes and backwaters, flying mostly over open water. The blue-powdered males have the habit of resting on dead twigs and on vegetation growing on the pond, keeping well out of the reach of an insect net. It is a very shy dragonfly, darting away on the slightest movement and flying very swiftly from one obstacle to the other, alternating its flight by short periods of hovering. Sometimes specimens are found numerously in disused boggy rice-fields with a rich aquatic vegetation. Thus, during my stay in the Karimoen Djawa islands, every bit of such low swampy ground was swarming with them during November. Also very common in May on the Danoe lake in Bantam, where great numbers were seen perched on the tips of rush-stems growing in the swamp. Females are only occasionally seen and prefer the seclusion of bamboo-groves and other shadowy places, often far from the neighbourhood of water. The eggs are laid without the male's assistance. Breeds also in oligohaline waters. Both sexes come to light at dusk.

West Java: Tjilegon; Rawah Danoe; Malimping (I) Batavia (II) Tjileungsi; Tjiampea; Tjiomas; Buitenzorg (III).

Mid Java: Patimoean; Koebangkangkoeng; Djeroeklegi; Babakan; Tjilatjap; all at sea-level (VII) Karimoen Djawa Islands (XII).

72. **Raphismia bispina** (HAGEN, 42) LIEFTINCK (74) DAMMERMAN (13, sub *Brachydiplax farinosa*).

Also new to Java. This is exclusively a littoral species, distributed all over the eastern islands of the Malay Archipelago, but hitherto not known further westward than Borneo and restricted almost everywhere to the coastal zone. First discovered on the Krakatau group of islands, in Dec. 1919, but since then also found on the little coral-reef islets off the N.W.-coast of Java and in the mangrove forests near Batavia. Probably occurring scatteringly in all similar situations in Java.

R. bispina is an easily captured insect, resting on twigs and roots with wings half open; when fully matured, the pruinose males are entirely unlike

the teneral stage. I have seen it literally swarming among the mangrove vegetation of the Karimoen Islands, both sexes being equally well represented. No specimens were observed outside these surroundings. The larva is very similar to *Diplacodes*.

West Java: Verlaten Island (Krakatau group), Dec. 1919, April 1921, Nov. 1932; former specimens identified by FRASER as *Brachydiplax farinosa*. Edam and Hoorn Is., in the Bay of Batavia, May 7, 1931, T. VAN BENTHEM JUTTING; Antjol, near Tandjoeng Priok, Jan. 25, 1931, AUTHOR (II).

Mid Java: Karimoen Djawa Islands (Java Sea), May 1926, DAMMERMAN, and Nov. 22-30, 1930, AUTHOR (XII).

73. **Acisoma panorpoides** (RAMB., 82) RIS (86).

The whole of Java, restricted to plain country. Fairly common, but local, in shallow marshes, among the swampy shore-vegetation of lakes and ponds, and in rice-fields. Hides among grass and sedges low to the water's edge, and owing to its cryptic colouring is a very inconspicuous and easily overseen insect. Flight weak. Habits otherwise much as in *Diplacodes trivialis*. Apparently also breeding in slightly brackish waters. The species was taken on the volcanic island of Krakatau, in Dec. 1919, and DAMMERMAN took two ♀♀ on Bawean Is. (Java Sea) in May, 1928.

74. **Diplacodes nebulosa** (FABR., 17) RIS (84, 86).

This species is found only in low marshy areas, occurring in small colonies in swamps and ponds. It is strictly limited to the neighbourhood of water and, according to FRASER, never leaves the marshes in which it has been bred. TILLYARD took this species in North Queensland and reports on it: "It flies about ten yards out from the edge of the swamp and keeps very close to the surface of the water. It can only be captured by wading. The motion of the wings is so quick that it is exceedingly difficult to see this insect when flying, though its actual progress is slow and very zigzag. It is fond of sitting on the very tips of grass and reed-stems sticking out of the water, with its wings depressed." (124). A larva from Bekassi, near Batavia, presumably referred to this species, was described by RIS (86). Very rare in Java and possibly only occurring along the north-coast at sea-level. Reported from near Batavia by RIS. I have seen only three females, all taken by JACOBSON near Batavia, in Dec. 1907, and in Febr. and Nov., 1908.

75. **Diplacodes trivialis** (RAMB., 82) BRAUER (2) NEEDHAM (81) RIS (86) KONINGSBERGER (50) DAMMERMAN (13, larva sub *D. nebulosa*).

Extremely abundant everywhere and at all elevations throughout the year. Frequents low, dry situations, mostly far from water. A very common insect in gardens or by roadsides where it rests on bare patches of ground, on foot-tracks through low grass, or on gravel-paths. The males are often seen skimming over the hot bitumen-roads and numerous specimens fall a victim of the radiator of passing automobiles. It is a very wary but inquisitive insect. When at rest

on some stone or wall, it turns about the observer, carefully studying his intentions, taking on a very peculiar attitude, viz. by holding the body almost straight up, while the wings are pressed strongly down.

The ♂ and ♀ are both, for many weeks after emergence, of a dull brown colour, with black markings. Later on, when quite matured, the thorax and abdomen of the male, and more rarely of the female also, become covered with a bluish bloom, except on the last segment or two, which are jet-black. The insect then appears entirely different from the described brown type. Breeds in all stagnant and slowly running waters. In the bush *D. trivialis* often falls a victim of large Asilid flies. Also common on the islands of the Krakatau group, on the coral islets in the Bay of Batavia, on Dapoer Is. (Thousand Islands), and in the Karimoen Djawa archipelago. I have further seen specimens from the Bawean and Kangean islands, in the Java Sea. NEEDHAM's larvae from Buitenzorg are, I think, correctly placed in this species.

76. **Brachythemis contaminata** (FABR., 17) RIS (84).

An easily recognised and common insect everywhere in the plains of Java, but occasionally also fairly abundant at high altitudes on mountain lakes. Highest recorded altitude 1460 m (Telagawarna, old crater-lake on Mt. Gedeh), and Danoe Pateungteun, 1500 m, near Garoet. It is on the wing in every month of the year, a continuous succession of broods appearing. Prefers shallow fish-ponds, lakes and tanks, where it is seen skimming the waves. Flight often interrupted, settling on floating leaves of *Nymphaeaceae* and low herbage round the borders of a pond. It is never seen away from water. The larva lives freely among choke-weed and other plants. Breeds also in drainage-channels and sluggish streams. The female oviposits unaccompanied by the male. Extremely abundant in the Botanic Garden of Buitenzorg. I once saw a female capturing an adult male of *Ceriagrion coromandelianum*.

77. **Neurothemis fluctuans** (FABR., 17) (BURM., 9) SELYS (113) CALVERT (10) KRÜGER (55) RIS (84) KONINGSBERGER (50).

Recorded from Depok and Buitenzorg by RIS. Moderately common and rather widely distributed throughout the year in West and Mid Java, but exceedingly local. Chiefly a plain species, but occasionally occurring also at high, or even very high altitudes. It restricts itself to lakes, big ponds or paddy-fields (s a w a h's), where it usually forms thickly populated colonies. A large colony, containing almost black-winged males, occurred on lake Danoe, favouring the damp jungle and the swampy area round the border of the lake. On occasions it may be seen flitting in countless swarms in paddy fields, and in such open country the males appear to have their wings less intensively marked with brown. On Mt. Slamat and in a few other localities (Soekanegara) this species probably intermingles with *N. palliata* and *terminata,* and I possess several perfectly intermediate specimens from these localities which doubtlessly are the result of cross-breeding. The female of Javan *fluctuans* belongs to a pale heterochromatic form. The larva has plant-dwelling habitats.

West Java: Rawah Danoe; Malimping (I) Buitenzorg; Depok and surroundings, common; Mt. Gedeh, Tjibodas and Sitoe Goenoeng, 1000-1400 m; Mt. Tjimerang, Djampang Tengah; Lake Njalindoeng, 900 m, common; Soekanegara, 900 m (III) Mt. Papandajan, Tegal Marioek, 2200 m, March 31, 1930, one male, C. VAN STEENIS (IV).

Mid Java: Noesa Kambangan, sea-level; Mt. Slamat, Batoerraden, 800 m (VII).

78. **Neurothemis intermedia excelsa** LIEFTINCK (75).

The Javan representative of this palely coloured species is rather intermediate between Indian *intermedia* and *N. nesaea* RIS, which in the writer's opinion is the most easterly distributed race of *intermedia*. The species is unknown from Sumatra and Borneo but very likely also inhabits the former island. Only two specimens, from widely distant localities, are known from Java.

Mid Java: One male (juv.), Patimoean, sea-level, April 19, 1929, DRESCHER (VII).

East Java: One male (ad.), Kedangan, 40 m, Dec. 2, 1927, F. VERBEEK (XV).

79. **Neurothemis palliata palliata** (RAMBUR, 82) RIS (84).

Only a single ♀, collected by FRUHSTORFER somewhere in Java, has previously been known from the island. Distributed all over Java. Rare and exceedingly local, but very plentiful where found. Habits identical to *fluctuans*, frequenting the immediate neighbourhood of water and preferring the grassy border of lakes. Very common throughout the year on lake Tjigombong, near Buitenzorg. On Mt. Pantjar I once met with large flocks swarming in a paddy field; a series here taken shows considerable variability in size and all specimens have more than one cross-vein in the cubito-anal field of the hind wing. Locally common on Mt. Slamat in all months of the year; among typical individuals several are exactly intermediate between *fluctuans* and *palliata;* and there is much evidence of these specimens being hybrids. Similar transition forms were taken by me near Soekanegara. As a rule, the male has more darkly pigmented wings than *fluctuans* and *terminata*. One out of a series of ca. 50 isochromatic females, from different localities, belongs to the clear-winged heterochromatic form (Mt. Slamat).

Oviposition was observed on lake Tjigombong, and is accomplished without the male's attendance; the ♀ skims over stretches of open water, hovering for a time over a definite spot and then drops swiftly, curving its abdomen strongly under the body, striking off her cluster of eggs two or three times and then again rises in search of a fresh spot.

West Java: Mt. Pantjar, 500 m; Tjigombong, 500 m; Wijnkoops Bay, sea-level; Soekanegara, 800 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III).

Mid Java: Mt. Slamat, Batoerraden, ca. 800 m (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

80. **Neurothemis terminata terminata** RIS (84, 86) (RAMBUR, 82) (BRAUER, 3, 7) (SELYS, 113) (KRÜGER, 55) DAMMERMAN (13).

The typical race of this species was originally described from Java. Rather a homogeneous species, commonly and widely distributed all over the island, from sea-level upwards to altitudes varying between 1400 and 1500 meters. *N. terminata* is not essentially gregarious in its habits, being found almost everywhere and in all seasons in moisty places, preferring marshes, ponds and rice-fields. Also abundant in forest-swamps, in woody meadows and in bamboo-groves. Breeds in still waters. Oviposition similar to *palliata*.

Javan females are heterochromatic and easily recognized by their smoky wing tips. The isochromatic form is very rare in Java; I have seen isolated specimens from the following localities:— Klappers islet (Poeloe Deli), off the S.W. point of Java, Febr. 1932; Mt. Karang, May 1931 and Malimping, April 1933 (I) Mt. Tjisoeroe, Djampang Tengah, Dec. 1932, and Soekanegara, Dec. 1931 (III) Tjipitjoeng, July 1934 (IV). I have examined a small series of males from Bawean Is., in the Java Sea, collected by DELSMAN and DAMMERMAN, April 1920 and May 1928, which do not differ in any way from specimens of West Java. A single heterochromatic ♀ from Kangean Is. (Java Sea), taken in April 1932 by VAN DELDEN, might eventually belong to *N. terminata obscura* FRAS. Once, Mr. DRESCHER took a male at light in Tjilatjap, on Jan. 17, 1928, which is exactly intermediate between *fluctuans* and *terminata*. Lastly, DAMMERMAN captured a single ♂ on Verlaten Is. (Krakatau group) in April 1920, and a heterochromatic ♀ on Krakatau Is. (Zwarte Hoek) in June, 1932; both specimens are true to the type.

This species is replaced in the Karimoen Djawa archipelago by:—

80a. **Neurothemis terminata obscura** FRASER (31).

Considered as a distinct species, but doubtlessly belonging in the same formenkreis. Differs very markedly from the typical race by the brown of the wings being more extensive, covering almost the entire wing surface. It is further distinguished by its closer neuration and decidedly darker pigmentation. *N. terminata obscura*, besides being darker, is on an average much smaller than typical *terminata* and the wings are comparatively broader with the tips more rounded. Extremely abundant in the Karimoen islands, breeding exclusively in fresh stagnant waters and avoiding the mangrove vegetation. Favours weedy marshes and paddy fields where it forms overcrowded colonies. In one such, near the capital village on P. Karimoen, the numbers were so great in November as to blacken the swampy rice-fields of the natives. Both colour-forms of the ♀ are equally well represented and all intergrades of the two extremes occurred in the same locality. Flight swift and buzzing, low to the ground. Also quite common on forest-paths and clearings in the wood, settling on branches and leaves in the sunshine. First noticed by DELSMAN, in Oct. 1920 and afterwards taken by DAMMERMAN in May 1926, and by myself in Nov. 22-30, 1930.

A single ♂, not morphologically different from true *obscura*, was captured by DAMMERMAN on Sebesi Is., off the southcoast of Sumatra, in April 1921. Curiously enough, the two examples collected in the proper Krakatau group (some 10 miles distant from Sebesi) do not differ from typical *terminata*.

81. **Neurothemis tullia feralis** (BURM., 9) CALVERT (10) RIS (84, 86) DAMMERMAN (13).

Widely but sparingly distributed in the coastal districts of the entire island, often far from water. A rather rare and very local species, but fairly common throughout the year in the marshy land around Batavia and also forming well populated colonies in southern Banjoemas, favouring marshes and flying over ponds. Apparently quite common in north-east Java, thus in the Samarang residency, from whence large series have come under my notice. According to FRASER, the typical race breeds in weedy tanks, their colouring being apparently protective in nature as they enjoy a total immunity from the agression of birds (28).

I have examined two ♂♂ from the coral-reef islet Enkhuizen, in the Bay of Batavia, taken in Nov. 1919, and DAMMERMAN took a single ♂ on Krakatau, Oct. 23, 1923.

West Java: Tandjoeng Priok; Batavia; Bekasi (II) Buitenzorg; Tjibaroesa; Tjiseëng; Mt. Gedeh, Tjibodas, 1400 m, six ♂♂, three ♀♀, Sept. 1895, CANNEGIETER (III). The last mentioned locality is quite unusual for this species.

Mid Java: Patimoean; Koebangkangkoeng; Djeroeklegi; isle Noesa Kambangan. All taken by DRESCHER (VII) Samarang; Telawa, teak forests, L. KALSHOVEN misit. (IX and XII).

East Java: Rembang; Padangan; Gedangan, common in the teak plantations, KALSHOVEN and F. VERBEEK (XV).

82. **Crocothemis servilia** (DRURY, 15) BRAUER (2) KRÜGER (54) NEEDHAM (81) RIS (84).

A very common species everywhere in Java, chiefly in plain and submontane countries, but also found on lakes high up in the mountains. Highest recorded altitude 2150 m (Tegal Boengbroeng, Mt. Papandajan, IV). The imago is on the wing during the whole year. Breeds alike in running and still waters.

Countless numbers of the glorious red males enliven the shore of our ponds and lakes, struggling for the mastery of their domain in the pursuit of other dragonflies. They perch on twigs or on the tips of leaves, and from such vantage-ground make sudden dashes at passing insects. A very pugnacious and swift-flying species.

The female is not accompanied by the male during oviposition and the eggs are deposited by tapping the water's surface in the usual Libellulid manner. In most cases the ♀ is let alone during the process of egg-laying, but each act of copulation which lasts from 5 to 15 seconds, may take place with a different ♂.

The larva lives freely among water-weed and aquatic plants. NEEDHAM's two specimens from Buitenzorg, referred to *Crocothemis* with much doubt, evidently belong to *Brachythemis contaminata*. On the other hand, the numerous larvae from the same locality, and identified by NEEDHAM as *Trithemis aurora*, agree closely in all respects with my material of *Crocothemis servilia* (81).

C. servilia is one of the chief representatives of the aquatic insect-fauna of the rice-fields (s a w a h' s) and, because of its destruction of mosquito larvae doubtlessly is of great economic importance as a really beneficial insect.

I have seen specimens from the coral-reef islet Enkhuizen, in the bay of Batavia, and a small series from Bawean Is., in the Java Sea, which do not differ from Javan specimens.

83. **Rhodothemis rufa** (RAMB., 82).

The only specimen heretofore known from the island, is the typical male that, according to LATREILLE, was discovered in Java. Distributed all over the island in low country up to about 600 m, being in flight in all seasons of the year. Not uncommon and sometimes very abundant, yet easily overlooked and mistaken in flight for *Crocothemis* and *Urothemis*, two species with similar habits with which it is often seen in company. The brilliantly scarlet red males are sun-loving and very wary insects, flying swiftly over the extensive *Pistia* fields and *Eichhornia* vegetation covering the surface of lakes, ponds and large tanks, and mostly keep well out of the reach of an insect net. The female has more retiring habitats and is very often seen away from water, hiding up in rank jungle, such as bamboo-groves in the immediate neighbourhood of its breeding place. The eggs are laid solely among plots of floating plants, and the curious black-bellied larvae are mostly found among *Spirogyra* and other weedy growth, keeping near to the water's surface.

Rhodothemis is fairly common on the *Lotus*-ponds in the Botanic Garden of Buitenzorg, but the localities in Java where it has been observed are still few in number.

W e s t J a v a: Rawah Danoe; Malimping (I) Depok; Tjiseëng, Tjibaroesa; Tjiampea; Buitenzorg; Tjigombong (III).

M i d J a v a: Djeroeklegi; Koebangkangkoeng (VII).

E a s t J a v a: Popoh, south-coast (XVI).

84. **Trithemis aurora** (BURM., 9) RIS (84).

Rather rare. Reported from 'Java' by RIS. Occurs sparingly at all elevations, from sea-level up to about 1600 meters, frequenting the borders of fish-ponds, mountain-lakes and, more rarely, streams flowing through swampy land. It is on the wing during the whole year. According to FRASER, this species prefers streams as a breeding-place in Western India, but in Java I have only met with small colonies over large ponds and lakes at rather high levels. On lake Pangkalan, I observed the oviposition of a ♀ flying over open water and dipping her abdomen in floating plots of *Utricularia*. The species is very abundant on

lake Njalindoeng, south of Soekaboemi, where I counted hundreds of specimens emerging from the grassy border of the lake, early in the morning of July 1, 1934. The nymphal skins were picked up from grass-stems, close to the water level.

Owing to their wariness, the males of this brightly coloured insect are very difficult to approach. They are fond of sitting on the projecting tips of dead branches, over open water, with their wings sloping.

West Java: Mt. Gedeh, Tjibodas and Lake Telagawarna, 14-1500 m; Mt. Tjisoeroe, Djampang Tengah, 600 m; Lake Njalindoeng, 900 m; Soekanegara, ca. 800 m; Zand Bay, sea-level (III) Mt. Patoeha, Telagapatengan, 1600 m; Mt. Limboeng, Tjisangiri River, 1000 m; Mt. Malabar, Pengalengan; Tjinjiroean, 1700 m; Danoe Pangkalan near Kamodjang, 1500 m; Mt. Kendang, Daradjat, 1650 m (IV).

Mid Java: Djeroeklegi, sea-level (VII) Samarang, teak plantations, low country (IX).

East Java: Mt. Ardjoeno (XVIII) Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

85. **Trithemis festiva** (RAMB., 82) RIS (84).

This is decidedly a riverine species, found commonly throughout Java over small rocky streams in wooded country at all levels up to 1500 meters. The males are never found away from the neighbourhood of water where they take up positions on rocks in the stream, often in considerable numbers. In southern Banjoemas, Mr. DRESCHER took this species in company with *aurora*, but this is the only record known to me of a locality in which both species occur together. The female is a rare insect and only seen when coming down to the water to oviposit. This is performed in a very rashly manner in shallow, swiftly flowing water, great stretches of a stream being patrolled by a single individual in search of a suitable spot.

West Java: Pasaoeran, plain streams; Bajah, south-coast (I) Mt. Salak, Waroengloa; Wijnkoops Bay and Tjisolok, plain streams; Mt. Gedeh, Selabintanah; Mt. Tjisoeroe, Djampang Tengah; Soekanegara (III) Radjamandala, Tjitaroem River; Mt. Tangkoeban Prahoe; Tjikasc River, near Tjipitjoeng (IV).

Mid Java: Djeroeklegi, plain level; Mt. Slamat, Batoerraden (VII) Samarang (IX).

East Java: Mt. Wilis (XVI) Mt. Raoeng (XX).

86. **Onychothemis abnormis** (BRAUER, 6) RIS (84).

In the collection of the Brussels Museum are one ♂ and two ♀♀ taken by FRUHSTORFER in 1893, probably in the southern districts of West Java, and a single ♂, lacking any locality-labels, collected by VAN LANSBERGE. These four insects are the only specimens known from the island.

O. abnormis doubtlessly is one of the rarest Libellulines still living in the

primeval forests of Java. The species should be looked for in deep ravines at the foot-hills of South Java, in dense jungle. It breeds in swift streams.

87. **Onychothemis culminicola culminicola** FÖRSTER (21) RIS (84).

Previously only known from a single ♀ (W. Java, STEUBEN, 1889), preserved in the Senckenberg Museum collection.

Rare. Widely distributed throughout the island, from 100 to about 900 m above sea-level in wooded country. Prefers the large sunny streams with a rich shore-vegetation along which it courses with swift flight at low elevation. Inhabits also rivers where the clay banks are high and are strewn thickly along the water's edge with boulders of various size; in such places the insect keeps well out of the banks, hawking rapidly to and fro over open water. The flight is frequently broken by long periods of rest on shrubs or on the foliage overshadowing the stream, mostly high above the water-mark. Females are only taken by chance; most specimens in my collection were put up by beating. The larva is unknown.

West Java: Pasaoeran, Tjilampir River, May (I) Depok, along the banks of a muddy stream with slowly running water, Febr.; Buitenzorg, July and Aug.; Mt. Halimoen, May; Mt. Tjisoeroe, Djampang Tengah, Jan. to Febr., May, June, July, Oct.; Soekanegara, Tjimonteh River, Dec. (III) Radjamandala, Tjitaroem River, Jan. (IV).

East Java: Mt. Raoeng, Bajoekidoel Est., April, Sept. (XX).

88. **Zygonyx ida ida** SELYS (109, 118) KARSCH (47) RIS (84).

Originally described from 'Java', and reported by RIS from the Priangan and the Tengger Mts.

This Corduliine-like dragonfly is found only in submontane regions, from 500-1600 m altitude, and distributed all over the island in all seasons of the year. Moderately common, though entirely restricted to dense original forest where the males may be seen hawking high in the air above forest-paths in the immediate neighbourhood of swift mountain streams. The very inconspicuous males are often seen hovering over rapids in midstream and are therefore difficult to get at. As in the Indian *Z. iris* SELYS, the females only come down to the water to oviposit and the males rendez-vous there to meet them, hawking slowly up and down stream on a limited beat, settling at times on low bushes or twigs overhanging the stream (FRASER, 28).

I have watched the oviposition of a ♀ hovering over a mountain-torrent just above the waterfall in the Tjimonteh, near Soekanegara. On that occasion the eggs were immediately dragged away by the water which roars over the boulders in this stream and probably settled down only at the foot of the cascade. The curious compact and strongly keeled larvae are found in rapid streams and take up a strong foothold against rocks, clinging to boulders and stones at transformation. Numbers of juvenile specimens were seen on emergence along the banks of the rocky Tjitaroem, near Radjamandala.

West Java: Mt. Megamendoeng; Mt. Gedeh, Tjiboenar Est.; Mt. Tjisoeroe, Djampang Tengah; Soekanegara (III) Radjamandala; Priangan; Pameungpeuk-Tjisompet, forest-streams, 300-900 m, common (IV).

Mid Java: Mt. Slamat, Batoerraden; specimens taken *in cop.* during the months June, Sept., and Dec. 1928 (VII).

East Java: Mt. Wilis (XVI) Tengger Mts (XIX) Mt. Ijang; Mt. Raoeng (XX).

89. **Zyxomma obtusum** SELYS (112).

Until recently, this widely distributed Trameine has remained unknown from Java. This is to be explained by its noctural habits and its remarkably secluded habitats. Contrary to my first supposition, I now have a definite proof of its occurrence in various localities in Java, from the coastal zone upwards to about 850 m above sea-level. The mysterious chalk-white males first appear on the wing between 5.30 and 6 *a.m.*, and then again between 6 and 6.15 *p.m.*, hovering like a phantom over forest-pools and shady tanks, and by reason of the white pruinescence of the entire body and the milky-white wings, are very striking insects when skimming over the black water. As a breeding place *Z. obtusum* seems to prefer still waters above streams, although L. MARTIN took the same species in North Celebes along streams, remarking: "fliegt nur Abends über fliessendem Wasser von 5.30 bis 6.15; sieht sehr hübsch und distinguiert aus durch ihre weisse Farbe über dem dunklen Wasser" (RIS, 84). JACOBSON, who captured *obtusum* on Simaloer Is., off the W. Coast of Sumatra, notices: "Diese Art ist schwer zu fangen wegen ihrem äusserst schnellen Flug. Fliegen nur kurz vor der Dämmerung von 5-6 Uhr Abends; verbergen sich im Tage" (RIS, 88). Similar observations have been made by Prof. HANDSCHIN in Bali, and by Prof. WOLTERECK in Central Celebes. In Java our species is remarkable in that it displays a high adaptability to human makings, inasmuch as tubs and all kinds of artificially made reservoirs in the open are frequently selected as a place for brooding. Thus, in the garden of the Zoological Laboratory at Buitenzorg, it has found a suitable breeding-place in a large cemented cistern, which sometimes is used as washing tub for tools and animal skins. Throughout the year this tank is teeming with mosquito-larvae and is continuously populated with tadpoles of two species of *Rhacophorus*, viz. the well-known "tree-frogs", whose frothy nests are attached to some bough overhanging the tank. The larvae of *Zyxomma* prey chiefly upon the mosquito-larvae and young Notonectid bugs living in the cistern.

On an inspection of the gullets and drainage-canals on the factory-site of the rubber estate Radjamandala, I once found many cast skins attached to the cemented walls of the eduction-gullies digged out around the factory. Messrs DRESCHER and BENNER took a fine series of both sexes in the morning-twilight just before sunrise, on the emplacement of an oil-factory near Tjilatjap, where the males were seen hawking mosquitos in the depths of two deep wells, flying close to the water's surface. According to these observers, the insect quite

suddenly disappears soon after sunrise. The nocturnal specimens, watched in the Botanic Garden also have a very short period of flight and not a single individual is to be seen after 6.30 *p.m.*

The larvae are bottom-dwellers, hiding among rotten leaves and débris, or crawling against the slithery growth of algae covering the wall of a tank. Females are rarely seen and only come down to the water to oviposit. The adult insect was captured or observed during the whole year.

West Java: Buitenzorg; Tjigombong, larvae; Wijnkoops Bay; Tjisolok, forest-pool (III) Radjamandala, tanks and gullies, exuviae (IV).

Mid Java: Tjilatjap, tanks; one juv. ♂ taken at light; Mt. Slamat, Batoerraden, beaten up in dense forest near mountain-brook (VII) Telawa, near Semarang, numerous specimens (IX).

East Java: Mt. Raoeng, Bajoekidoel Est. (XX).

90. **Zyxomma petiolatum** (RAMB., 82) RIS (84).

Only a single ♂, labelled 'Java', has been made known from the island. Possibly rather a common species in the lowlands. Like the foregoing, this elusive insect has typically crepuscular habits, the duration of its flight being rather longer than in *obtusum*. In the Botanic Garden of Buitenzorg the first individuals appear at about 5 *p.m.* in the dry season, becoming increasingly abundant towards sunset, e.q. shortly before 6.15 *p.m.* Usually all insects have disappeared soon after night has set in for good, but I have observed stray specimens (males) coming to the light as late as 11 *p.m.* *Z. petiolatum* is the most inconspicuous and quite the swiftest dragonfly I have ever seen on the wing, "pursuing a rapid irregular restless flight round the borders of tanks", which coupled with the obscureness of its thin body, its transparent wings and the darkness of the surroundings renders it a most difficult insect to take. FRASER has captured it in Western India after dark by striking at its shadow as seen silhouetted against the light reflected from the surface of the water; and this is really the only way to obtain a fair series of specimens in one locality, for the insects themselves are nearly invisible (FRASER, 25, 28).

In Australia it was taken by TILLYARD "in only one spot, some ten miles out of Cairns, Queensland, flying swiftly up and down a creek in the guava scrub, at dusk. It often hovers quite motionless in the air for a long time and when flying, almost skims the surface of the water" (125).

In the Botanic Garden of Buitenzorg, *petiolatum* occurs plentifully in a dark corner of the Victoria pond where the water is shallow and devoid of aquatic vegetation. Near the outlet of this pond a dark recess is formed by the foliage of some big *Nephelium* trees overhanging the water, and when the last rays of the sun illuminate the trees, this quiet place is suddenly enlivened by the glittering wings of the tiny dragonfly which in passing may be seen hovering very low over the water. The females are the first on the wing and on cloudy days appear at 4.30 *p.m.*, thus at a time when the sun is still brightly shining. These early arrivals, on account of their pale brown abdomen,

are more easily noticed than the ♂♂, and come down to the pond chiefly to deposit their eggs. This is performed in a very nervous manner by tapping the end of abdomen against floating leaves which have just swept down into the water. The eggs are produced singly, or but a few at each stroke and are enveloped by a very sticky gelatinous substance which immediately adheres to the substratum. In July and August it is not before 5.45 *p.m.* that the ♂♂ appear, and from then onward scores of them fly round the border of the pond. Most of the ♀♀ are then snatched away and carried along with their mates to the dense foliage of adjoining trees. I have not been able to ascertain the duration of the copulatory act, but I think it will soon be accomplished. The period of development, from oviposition till emergence, amounts to about six months.

So far as my own experience goes, *Z. petiolatum* breeds only in still waters, frequenting shallow leaf-bottomed ponds and muddy forest-pools. The larvae hide among débris and dead leaves and are well protected against enemies. The nocturnal habits of the adult account largely for its comparative rarity and scarceness in collections. I have observed the ♀ ovipositing in Febr. and Aug. (Buitenzorg), and in March (Babakan). A detailed account of the life-history will be published at some other place.

West Java: Tjileungsi, forest-swamp, May; Buitenzorg, Febr., Aug., Dec.; Tjibadak, Febr., in railway compartment; Soekaboemi; Mt. Tjisoeroe, Djampang Tengah (III).

Mid Java: Babakan, near Tjilatjap, March (VII).

91. **Tholymis tillarga** (FABR., 18) (BURM., 9) CALVERT (10) RIS (84) KONINGSBERGER (50).

Of this widely spread and common insect only few authentic specimens, collected a century or so ago, have been reported from Java. Yet, it is quite an abundant species, found everywhere from sea-level up to considerable altitudes. So far, the highest recorded locality is on Mt. Tangkoeban Prahoe, 1500 m. Like the last, *Tholymis* is decidedly a crepuscular insect, displaying the same restless flight as is characteristic to the species of *Zyxomma*. The following remarks are quoted from FRASER's observations on Indian examples: "In Bombay *tillarga* appears on the wing soon after 6 *p.m.* and from then onward till long after dusk a continuous stream of the insects may be seen pursuing each other round the borders of tanks. The males are the first on the wing and by reason of the opalescent patch on the hind-wings, which has a distinctly luminous effect not unlike phosphorescent paint, it is easily distinguished. The females appear later and, as they have not the same distinctive mark as the male, they are seen with difficulty" (25). "In Coorg the insect appears on the wing at a quarter to six (Dec.-Jan.), one or two at a time, but quickly augmented until the air is swarming with them. Their flight and actions are apparently governed directly by that of the small insects on which they feed, for at one moment the swarm flights high and at another descends

to skim the surface of the ground. At a quarter past six the whole swarm disappears with dramatic suddenness" (28).

From my own experience in the field I have noticed that the whirling flocks of males as twilight comes on fly nearer and nearer the water's edge as the flocks of small *Diptera* settle on the earth. In Java *T. tillarga* is occasionally seen flying during the day over shady pools and forest-marshes, but usually they hide up under the shelter of bushes from which places they may often be beaten up. Breeds chiefly in still waters, such as ponds, canals and paddy-fields, but on various occasions I have watched the oviposition in shoals of muddy streams. Like *Pantala* it is a species with strong migratory tendencies, occurring abundantly near the sea-shore and breeding freely in brackish water marshes.

In April, 1921, DAMMERMAN took a ♀ on Sebesi Is. (Strait Sunda), and I have captured it myself in the Karimoen Djawa islands. Along with other nightflying species, such as *Zyxomma* and most of the regional Aeschnines, *Tholymis* is one of the principal mosquito-destroyers and therefore of great economic importance. Adults are on the wing the whole year round.

In general appearance, the larva is rather intermediate between that of *Zyxomma* and *Rhyothemis*.

92. **Pantala flavescens** (FABR., 18) SELYS (102) CALVERT (10) KRÜGER (54) RIS (84) KONINGSBERGER (50) DAMMERMAN (13).

Cosmopolitan and chiefly circum-tropical. Found very commonly in almost any environment, often far from water. A migratory species, breeding in all stagnant and slowly running waters, from sea-level up to ca. 2800 m alt. This species has gregarious habits and big swarms may be seen flying promiscuously over roads and lawns, where they are preying chiefly upon mosquitos, mayflies, &c. Although it moves swiftly, sometimes at a considerable height from the ground and but seldom alights, *Pantala*, by its inquisitiveness is easily captured on the wing. It is also a very common insect near the watering places of buffalos and horses, and large flocks are sometimes seen flying high in the air over pools frequented by cattle. Near Malimping, in S. Bantam, I have watched this species sailing over buffalo-tracks and actually preying upon cattle- and dung-flies which were very numerous there. The copulation takes place on the wing but is not often noticed. The larva is rather similar in outward appearance to *Tramea* but easily distinguished from other Trameine larvae by the shape of the mask and the black tarsi of middle and hind legs. They may be sought in weedy tanks, rice-fields and ponds where they contribute greatly to the extermination of mosquito-larvae. It may safely be maintained that *Pantala*, in the imaginal as well as in the larval stage should be considered as of the utmost beneficial importance.

RIS has called attention to the fact that, corresponding to the exceptionally broad and also thin and flexible anal field of the hind wings, we find in *Pantala* a faculty of planing or sailing flight which faculty is probably responsible for its excessively wide distribution. It has been recorded from

many oceanic islands not inhabited by any other dragonfly and has repeatedly been observed on board ships far from shore. Various records testify to it being a wanderer and sometimes assembling in immense numbers. In November 1932, DAMMERMAN took a single ♂ on Verlaten Is. (Krakataugroup), and on various occasions I have observed specimens on the dry coral-islets in the Bay of Batavia. Occurs also in the Karimoen Djawa group of islands and often comes to light after dusk.

93. **Rhyothemis phyllis phyllis** (SULZER, 123) BRAUER (2, 4, 7) CALVERT (10) KRÜGER (54) NEEDHAM (81) RIS (84, 86) DAMMERMAN (13).

Terra typica unknown, but possibly Java. Reported from Batavia and Samarang by RIS. Moderately common and locally abundant in swampy country, from sea-level up to 1400 m alt. Chiefly a plain species, breeding in marshes, ponds and old weedy tanks. Although adorned with a strikingly beautiful wing-pattern, *R. phyllis* is rather an inconspicuous insect when on the wing. This is due greatly to its peculiar habit of swarming socially round the tops of bushes and small trees, often high in the air. Solitary specimens may often be seen fluttering up and down round the grassy border of some pond, displaying a very characteristic weak undulating flight, alternated by long periods of hovering.

On lake Danoe in Bantam, I have observed scores of this dragonfly fluttering in couples about two meters from the ground and driven off by a strong wind to find shelter in the neighbouring scrub.

The larva has adapted a life in shallow, mud-bottomed ponds and is but rarely found among aquatic plants.

R. phyllis is distributed over the entire island and eastern specimens are not different from the West Javan type, except for being of rather smaller size. It is often noticed in the coastal regions and possibly breeds also in oligohaline waters (Antjol near Batavia; Babakan near Tjilatjap). On Hoorn Is., I once observed a swarm flying round the top of a high tree. It is quite a common species in the Botanic Garden of Buitenzorg. A description and photograph of a full-grown larva, collected in this locality, was published by NEEDHAM (81).

94. **Rhyothemis triangularis** KIRBY (48) RIS (84).

In the collection of the Brussels Museum are two ♂♂ of this very rare species, labelled 'Java, FRUHSTORFER', which have been discussed by RIS. I have examined five other (much damaged) individuals, collected many years ago by REINWARDT and V. EYNDHOVEN, all bearing the locality-label 'Java' without further comments. These are the only known *triangularis* from the island. With the excessive cultivation this species has possibly become extinct in Java. According to FRASER, Indian *triangularis* breeds in tanks (28).

95. **Hydrobasileus croceus** (BRAUER, 5) RIS (84).

Rather rare. Previously only known from a single ♀ in the Brussels Museum, collected by FRUHSTORFER in Java. Widely but sparingly distributed all

over the lowlands of West and Mid Java, breeding in marshes, lakes and ponds. Highest recorded altitude 850 m (Mt. Slamat).

Like *Tramea* and *Rhyothemis* it favours shallow waters with an abundant growth of rushes and cat-tails round the border and with a rich vegetation of aquatic plants. On hot sunny days it may be observed in every time of the year flying over two or three *Lotus*-tanks in the Botanical Garden of Buitenzorg. The males are easily distinguished from *Tramea* on the wing by their pale brown dress and graceful sailing flight. It always keeps well away from the water's edge, hovering infinitely over *Lotus*- and waterlily-plants but disappears suddenly as soon as the sky becomes overcasted. Its egg-laying habits and copulation are much the same as in *Tramea* and have very effectively been described by FRASER: "The males are found ceaselessly perambulating over weedy tanks, awaiting the arrival of females. Should a pair of males meet, they at once engage in fierce combat, ascending to a great height and often lost to sight. The conquering male, however, soon returns to the tank and this with magical swiftness. A male and female, when linked up, travel low over the water's surface tandem fashion, searching for a suitable spot to oviposit in. Meanwhile the female steadily exudes a mass of eggs which can be clearly seen, even from a distance, as a rapidly growing white spot at the end of the abdomen. Often the pair hover for a time over a definite spot and then apparently not satisfied pass on to another. The reasons for this are the dangers of being snapped up by fish or frogs, very real dangers too as frogs are constantly seen to leap at the hovering insects. The male apparently assumes full responsibility for the safety of any spot for it voluntarily releases the female which drops swiftly and deposits her bunch of eggs on some floating weed and again rises, the male adroitly resuming his hold on her neck. The search for a fresh spot is then resumed" (28).

The larva is a very graceful, transparent green creature which lives freely among soft aquatic plants, and owing to its cryptic coloration is not easily detected.

West Java: Pasaoeran; Malimping (I) Buitenzorg; Tjigombong; Mt. Tjisoeroe, Djampang Tengah (III) Lake Pantjaloe, Tasikmalaja (IV).

Mid Java: Mt. Slamat, Batoerraden; Djeroeklegi; Babakan (VII).

96. **Tramea limbata euryale** (SELYS, 112) (KRÜGER, 54) NEEDHAM (81) (RIS, 84, 86) DAMMERMAN (13).

Originally described from 'Java'. Like the last chiefly a lowland species, preferring open sunny country; much commoner than *Hydrobasileus* and almost universally distributed. It is a migratory insect par excellence, often wandering far from its breeding places and ascending to high altitudes (*e.g.* Mt. Tangkoeban Prahoe, 1600 m). It is quite a common insect in the littoral zone, great numbers being usually seen in low marshes behind the beach, where I have watched the oviposition of pairs flying over shallow lagoons with a rich growth of *Enteromorpha*. Also a regular visitor of old paddy-fields, where

solitary males may occupy a certain area for many successive days, although it often remains unnoticed because of its hawking high in the air. Sometimes large flocks are assembled flying round tree-tops in the pursuit of small insects, or hunting wildly together in forest-clearings. Breeds in all stagnant waters including those which are brackish. Habits and mode of oviposition otherwise very similar to *Hydrobasileus* with which it is often mixed.

In the Botanic Garden of Buitenzorg the males, which in the early morning are flying high and wide, come to the ponds on the look-out of females when the heat of the midday has increased activity. The females are usually catched on the wing, every one having a very attentive male companion. While holding her the pair flies about over the surface of the pond, stopping occasionally to oviposit and poising few inches above the water. The ♂ then releases its partner and remains poised while she drops and with a short swing taps the surface two or three times, when she again rises to the ♂ who instantly grasps her thorax with his claspers without first seizing her with his feet. This quick release and the almost immediate reclasping of the ♀ is a very dexterous performance and was first described by KENNEDY, for the nearctic *T. lacerata* HAGEN.

The yellow eggs are almost circular in outline; of a great number laid on March 10, the first larvae hatched out in the laboratory on March 18, and on the 21th of that month nearly all eggs had produced young larvae. These grow rapidly and the metamorphosis is completed within five months.

NEEDHAM has published a short description, accompanied by a photograph, of the full grown larva, collected by FAIRCHILD somewhere in Java.

Of this insect I noted stray specimens on the coral-reef islet of Hoorn, in the Bay of Batavia; and DAMMERMAN once took a ♂ on Verlaten Is. (April, 1920). Quite common in the Karimoen Djawa islands (Java Sea), and not morphologically different from Javan specimens.

97. **Camacinia gigantea** (BRAUER, 3) RIS (84).

Previously recorded by RIS from 'Java' (one ♂). A single ♀ in the Leiden Museum is labelled 'MÜLLER, Java'.

A rare and probably very local species with a wide distribution outside Java. It is the largest Libelluline inhabiting the island. Restricted to low country and found principally in non-cultivated areas, preferring the sunny border of weedy ponds or boggy situations in the midth of marshy land. On calm days the males are easily recognized insects when soaring over some waterlily-pond, but the females live secretly, hiding up in long grass in the vicinity of their breeding-place. Mr. DRESCHER took a fine series of this species in the swampy districts of S. Banjoemas, where both sexes occurred plentifully over small puddles cram-full of *Nymphaeaceae,* which were almost dried up. In 1930, on April 5, four males were here seen for the first time, perambulating over one of the ponds, and on a second visit to this spot, on June 20 and 21, the same pool had dried up completely but the insect was still present, three

males being taken. Similar pools in close vicinity of the former yielded many specimens during October, November and December of the same year, but as most of this rich country has since been drained, Odonate-life was soon left to perish.

Little is still known concerning the habits of *Camacinia gigantea*, but TILLYARD, who studied the behaviour of its eastern relative *othello* TILL., says of this species: "Its flight is low and majestic, and it is fond of settling on prominent twigs or branches overhanging the water" (125). The curious habit of resting on twigs is quite unique among the larger Trameines and found back again in the more specialized genera *Urothemis*, *Macrodiplax* and *Aethriamanta*.

In the mangrove scrub of Karimoen Djawa (Java-Sea), I have been fortunate enough to make the same observations on two males of *gigantea* flying slowly back and forth over a brackish water pool, enclosed by a tangly growth of *Sonneratia* and dead shrubbery. Occasionally, they suddenly rose high up into the air, settling on the tip of a dead branch, often many yards above the ground and remaining quite inert for a considerable time. Over the same pool a few males of *Neurothemis terminata obscura* were fluttering about and now it happened that, whenever *Camacinia* came within striking distance, *Neurothemis* flew straight aloft, following its trail closely until being at fault and swinging round to its former resting-place. This behaviour made strongly the impression as though both insects stood on a footing of intimacy with each other, the resemblance both in colours and attitude being very striking. To my great surprise, I noted afterwards that LAIDLAW, who observed our species in the Malay Peninsula at Kuala Aring, was struck by a quite similar coincidence, writing as follows: "Two fine males were taken at Kwala Aring, where this species is fairly abundant near pools in open spaces. It is very difficult to catch, being a powerful flier. It haunted the same localities as *Neurothemis stigmatizans* [*N. fluctuans* F. is here meant], which resembles it very closely in colour, though of course much smaller". (56). In the previous event, I was particularly struck by this difference in size being entirely abolished by the distal portion of the wings of *Camacinia*, which is wholly transparent and hence invisible during flight.

I have watched the oviposition of two ♀♀ in an old paddy-field on Karimoen Is. The insects were seen skimming the green meadow closely and then suddenly duck away amidst sedge-hassocks and grass, hovering motionless for many minutes just above the water's surface with legs pressed closely to the body and with the thick abdomen bent downwards under a right angle, tapping violently the end of it against plots of slithery weed on the surface of the very shallow water. The protruding eggs are brightly pink-coloured and are released singly, one or two eggs only being laid with an interval of one second between two dips. This curious operation was observed during some length of time before it was put an end by a stroke of my net. Most of the eggs deposited on Nov. 26, hatched out between Dec. 5 and 8, the first larva being noticed on Dec. 2, 1930. The full-grown larva will be described elsewhere.

Besides numerous specimens from the Karimoen Djawa group of islands taken by myself in Nov. 23-30, 1930, I have received some examples of the Kangean archipelago, taken by Mr. VAN DELDEN, in April 1932.

West Java: One ♂, Buitenzorg, Oct. 20, 1930, "at lamp", VAN STEENIS (III).

Mid Java: Numerous specimens, Djeroeklegi and Koebangkangkoeng, April, June, Oct., Nov. and Dec., 1930, 1932, DRESCHER (VII) Karimoen Djawa Is. (Java Sea) (XII).

98. **Macrodiplax cora** (BRAUER, 3, 4) RIS (84, 86) DAMMERMAN (13).

A rare species with strong migratory tendencies, found during the whole year but almost exclusively in the littoral zone. It prefers open breezy situations, such as brackish water marshes, lagoons and river-mouths, where both sexes may be found flying along the grassy border of the water. Locally very abundant in the mangrove vegetation and in dry bush near the coast. In several places found to be gregarious, scores of males being sometimes seen perched on prominent twigs of the highest tree-tops and shrubs. It is one of the wariest dragonflies I have attempted to take. Flight swift but often interrupted. In South Banjoemas I have observed the oviposition of a ♀ in a coastal lagoon where the water is brackish, and on a short visit to the coral-reef of Enkhuizen, in the Bay of Batavia, I saw great numbers of *cora* resting on heads of long grasses and dead twigs, just behind the beach. In one spot I found the hot wind had driven a swarm to the shelter of a tree, where hardly a twig could be seen that had not its occupant. These dragonflies were evidently blown by wind and may readily disperse to other islands (May 22, 1934). In Dec. 1919, DAMMERMAN took a ♀ on Verlaten Is. (Krakatau-group). I have further examined a number of larvae collected by Mr. HOEKS on lake Bagendit, near Garoet (IV). This is the only locality known to me so far inland.

West Java: Enkhuizen Is., May, common; Tandjoeng Priok, March; Batavia, July; Antjol, common in the mangrove scrub, Jan. (II) Lake Bagendit, near Garoet (IV).

Mid Java: Babakan, sea-level, common throughout the year in coastal marshes; isle Noesa Kambangan, June (VII) Samarang, July 1910, JACOBSON (*cf.* RIS) (IX).

East Java: Soerabaia (XVII).

99. **Urothemis signata bisignata** (BRAUER, 6, 7) SELYS (114, 119) RIS (84, 86).

Only a single ♀, captured by JACOBSON near Samarang, has previously been reported from the island by RIS. Probably distributed widely throughout Java in low country, and locally abundant but easily overlooked and mistaken for *Rhodothemis* and *Crocothemis*, two species with which it is often seen in company. Prefers the sunny borders of lakes, ponds and sluggish streams, especially where the surface of the water is concealed by a rich vegetation of *Pistia* or *Eichhornia*. In such situations the brightly crimson males may be

seen boisterously pursuing each other, settling at times on leaves and reed-stems but keeping always well out of the reach of an insect net. On Lake Tjigombong the males frequently rest on the tips of dead *Gleichenia* ferns overhanging the water. Besides being distinguished from other red-bodied species by a jet-black streak on segm. 8 and 9 of abdomen, the body is broader and most intensively blood-red in colour. It is a shy, swift-flying insect and hence very hard to catch. Our collection contains but few specimens.

On various places I found the young transparent larvae between rootlets of aquatic plants, such as *Eichhornia crassipes*. The copulation was observed by me in September, and by DRESCHER in March and July, so that we may safely assume that it is in flight the whole year round. Moreover, the larvae are to be found at any time of the year. The ♀ oviposits unaccompanied by the ♂, the eggs when freshly deposited being grass-green in colour.

The various races of the Indian *U. signata* (RAMB.), including *U. abbotti* LAIDLAW from Malaya, will very likely turn out to represent distinct species. I cannot judge whether the Javan form is subspecifically distinguished from typical *bisignata* as I have not examined Philippine specimens. Sumatran examples of *signata* have never been described.

W e s t J a v a: Rawah Danoe, abundant in May, AUTHOR (I) Batavia, VAN LANSBERGE; Lake Nagrok, near Pagadenbaroe (Krawang), ult. Nov., B. M. HOEKS (II) Depok, Sept., AUTHOR; Buitenzorg, Botanic Garden, rare throughout the year, AUTHOR; Lake Tjigombong, March, Sept., common, AUTHOR (III) Lake Bagendit, near Garoet, May-July (IV).

M i d J a v a: Djeroeklegi, Jan., March, Aug., fairly common, DRESCHER (VII) Samarang, June-July, JACOBSON (IX).

100. **Aethriamanta aethra** RIS (84, 86).

Of this very interesting little species I have examined the unique type-specimen, a ♂ in the late Dr. RIS's collection and four further examples, one defective ♂ and three ♀♀, which are preserved in the Leiden Museum collection. The latter unfortunately remained undescribed, but I hope to discuss the ♀ at some other place. The incomplete ♂, just mentioned, is not yet matured, lacking entirely the delicate bluish pruinescence covering the thorax and part of the abdomen of the adult, which looks quite different from teneral examples.

On a visit to the virgin forest-marsh Rawah Danoe, in Bantam, countless males of this species were observed by me resting on the tips of bull-rushes with their wings drooping and the abdomen held straight out. From this lofty look-out they made sudden dashes at passing insects and, when disturbed by the approach of our 'p r a h o e', they flew up from afar but soon returned to the tips of some other rush-stem. It was found a very wary insect and extremely difficult to catch. The ♀ was not seen, but I managed to secure a few larvae from between the submersed rootlets of *Trapa* and *Pistia stratiotes*, while several nymphal skins were collected from the leaves.

West Java: Two ♂♂ ad. (numerous seen), Rawah Danoe, May 25, 1931, AUTHOR (I).

Mid Java: One ♂ semiad., Samarang, June 1909, JACOBSON (IX).

The other specimens (♂ and 3 ♀♀) were collected by GROEN, somewhere in Java.

Subfam. Corduliinae.

101. **Hemicordulia tenera** LIEFTINCK (68).

Originally described from Mt. Slamat in Mid Java, from where only a single ♂ has come to our knowledge. A second specimen was taken in the hill-country south of Pasir Nangka, near Leuwimangoe, at an elevation of ca. 600 m above sea-level. This was hovering about 6 ft. high over a small brook with deep water flowing through marshy land; it was the only specimen seen.

Apparently a very scarce species, though possibly widely distributed, for I have also received specimens from near Singkawang, in West Borneo, where it is said by Mr. COOMANS DE RUITER to fly also after dusk. The only Bornean species reported from that island by LAIDLAW is *asiatica* SELYS. *H. tenera* is most closely related to *silvarum* RIS, from New Guinea, and is one of the slenderest species known. The members of this genus are swift and inconspicuous insects, whose larvae breed in clear weedy bog-ponds, or in slowly running waters.

West Java: Leuwimangoe, 600 m alt., Dec. 25, 1931, AUTHOR (III).

Mid Java: Mt. Slamat, Batoerraden, 850 m alt., Febr. 14, 1929, DRESCHER (VII).

102. **Procordulia artemis** LIEFTINCK (68, 72a).

Until recently only known from Java. It is a fairly common mountain species, occurring in colonies throughout West and Mid Java in all seasons of the year. Breeds in forest pools, marshes and mountain-lakes, round the borders of which the males may be seen hawking speedily up and down, usually keeping low to the surface of the water. Owing to its dull colouring and slender body, they are taken with difficulty. The ♀ oviposits in boggy situations, usually in stagnant waters. Elsewhere full information upon the habits and life-history of *P. artemis* has been given.

West Java: Mt. Salak, Sitoe Hiang, 1300 m, crater-lake, very common, AUTHOR; Mt. Gedeh, Telagawarna and Telagasaät, Poentjak pass, 14-1500 m, fairly common, AUTHOR (III) Mt. Tangkoeban Prahoe, 1500 m, forest pool, DRESCHER; Mt. Goentoer, Kawah Kamodjang, 1650 m, common in marshes, AUTHOR; Mt. Kendang, Lake Tjibeureum, 2100 m, very abundant, AUTHOR; Mt. Papandajan, 2000 m, AUTHOR (IV).

Mid Java: Diëng Plateau, ca. 2000 m, common, T. VAN BENTHEM JUTTING and F. DUPONT (VIII).

Dr. TOXOPEUS informs me that this species is very abundant on Mt. Tanggamoes, southern Lampong districts, South Sumatra, where he captured a fine series of males, from 1700 m upwards to the very summit of this mountain,

2100 m above sea-level, in June and July, 1934. Possibly, *artemis* has a wide range in the mountains of Sumatra.

103. **Procordulia sumbawana** (FÖRSTER, 20) FRASER (31, sub *karnyi*) LIEFTINCK (68, 72a).

Like the last restricted to high altitudes, from 800 to 3000 m above sea-level. Occurs throughout the year in most parts of the island and, though breeding only in running waters, much a commoner insect than *artemis*. Many specimens were taken by myself at elevations above 1500 m. Below this its place seems largely to be taken by *artemis*, which breeds only in stagnant waters. On Mt. Papandajan and the Diëng Plateau both species occur together but while *artemis* inhabits the marshes and lakes, *sumbawana* is either found hawking over forest-brooks or over small streams in open country. Quite common on Mt. Gedeh and various other volcanoes in West Java. Like *artemis* the males have the habit of hovering for long periods in the air and, accordingly, often remain unnoticed. Their flight is usually low and takes place only during sunshine, a cloud passing over being the signal for their immediate disappearance. In the Gedeh and Papandajan mountains the males were often observed flying high and airily over forest-ridings, or patrolling the banks of very small brooks flowing through *Anaphalis* wildernesses. Solitary males readily choose small sunny glades in thick forest or deep ravines, where the sun only penetrates at its zenith.

Further notes concerning life-history and distribution are to be found in the author's two papers on *Procordulia*.

West Java: Mt. Mas, 1450 m; Mt. Gedeh-Panggerango, 800-3000 m (III) Mt. Tangkoeban Prahoe, 13-1400 m; Mt. Papandajan, 15-2500 m (IV).

Mid Java: Mt. Slamat, 850 m (VII) Diëng Plateau, 2150 m; Mt. Merbaboe, 1500 m; Mt. Soembing, 1800 m (VIII).

East Java: Mt. Lawoe, Sarangan, 1300 m (XIV) Tengger Mts., 1500 m (XVIII).

104. **Idionyx montana montana** KARSCH (45a) KRÜGER (53) MARTIN (79) FRASER (31).

Described by KARSCH from 'Java' and reported also from the island by KRÜGER and MARTIN. The last author discusses two ♂♂ and three ♀♀ captured by FRUHSTORFER in southwest Java, 1893 and deposited in the Brussels Museum collection. *I. montana* is a rare woodland species, occurring in hilly regions. Apparently distributed all over the island in suitable places, breeding in forest-pools and possibly also in slowly running waters. Nothing is known of the life-history. The Indian species of *Idionyx*, according to FRASER, vary much in the selection of their breeding-places, and while some are rather crepuscular in habit, not appearing on the wing until late in the day, others are sun-loving and have habits quite similar to *Procordulia*. Many species of eastern distribution breed in rivers, the males being then observed following the course of mountain streams, hugging the water closely, apparently searching

for females. The latter are said by FRASER to oviposit in mud or wet sand, often penetrating deep undergrowth for this purpose. The larva is unknown.

Male specimens in my collection from South and Central Sumatra, from where it was also recorded by RIS, are not different from Javan individuals. From Borneo I have only seen typical *I. dohrni* KRÜG., a species likewise found in Sumatra. According to LAIDLAW, Bornean specimens of the last figuring under the name of *I. dohrni borneensis* LAID., are racially distinct from *dohrni*, but RIS is inclined to place them in the *montana* formenkreis. About 20 Javan specimens of both sexes, taken at various intervals and in all months of the year, have come under my notice.

W e s t J a v a: Mt. Tjisoeroe, Djampang Tengah, 600-800 m, all the year round, native coll. (III).

M i d J a v a: Mt. Slamat, Batoerraden, 850 m, June to Dec. 1928, and May 11, 1929, DRESCHER (VII).

E a s t J a v a: Mt. Raoeng, Bajoekidoel Est., 500 m, Jan 1933, LUCHT (XX).

105. **Macromia cincta** (RAMB., 82) SELYS (110) MARTIN (79) LIEFTINCK (65).

Terra typica unknown. Beside RAMBUR's types, a pair in very dilapidated a state of preservation, I have examined a ♂ and ♀ collected by S. MÜLLER somewhere in Java, preserved in the Leiden and Brussels Museum, respectively. These are the only specimens which I have seen from the island. *M. cincta* is typically a species of the plains and very likely breeds in stagnant or slightly running waters. In West Borneo it has been observed in cultivated country as well as in original growth forest, flying up and down by-paths in wooded districts. Apparently extremely rare in Java.

106. **Macromia gerstaeckeri** KRÜGER (53) MARTIN (79) LIEFTINCK (65).

Originally described from a single pair taken in 'Java'. In the collection of the Brussels Museum is a ♀, lacking its abdomen, taken by FRUHSTORFER in southwest Java. MARTIN adds Borneo and Tonkin to its habitation, but these records are at the best very doubtful. No further specimens appear to have ever been found in Java.

107. **Macromia moorei fumata** (KRÜGER, 53) (MARTIN, 79) LIEFTINCK (65).

Likewise described from Java. Four examples, three ♂♂ and one ♀, in the Brussels Museum are labelled "Java, FRUHSTORFER 1893".

A rare woodland species, occurring sparingly in the mountains of West Java at altitudes varying between 600 and 1600 m. There is much evidence of this species being on the wing during most time of the year, for it was captured by Mr. DRESCHER and his native assistants on Mt. Tangkoeban Prahoe in five different months.

First discovered flying over a very small muddy pool, situated in the depths of a funnel-shaped ravine surrounded by dense primeval forest where the sun penetrates only from about 10 to 12 o'clock in the morning. Solitary

specimens of both sexes were seen hovering over this pool during five years in succession but only five specimens could be secured on as many occasional visits! On May 10, Mr. DRESCHER caught a ♀ ovipositing in the wet mud at the border of this pool; hence there is definite proof of *moorei fumata* breeding in stagnant water. From Mr. BARTELS I have lately received a couple of males captured by him along a stream on the southern slope of Mt. Gedeh. The life-history and larva are as yet unknown.

West Java: Two ♂♂, Mt. Gedeh, Sept. 1934, M. E. WALSH and two ♂♂, Mt. Gedeh, Sitoe Goenoeng, along the Tjigoenoeng, 1000 m, Oct. 1933, E. BARTELS; one ♂, Mt. Halimoen, 600 m, July-Aug., 1927, native coll.; one ♂, Mt. Tjisoeroe, Djampang Tengah, 600 m, 1932 (III) Two ♂♂, three ♀♀, Mt. Tangkoeban Prahoe, 15-1600 m, Aug. 24, 1929, May 10 and June 23, 1930, Dec. 27, 1932, and March 29, 1934, DRESCHER (IV).

108. **Macromia septima** MARTIN (78, 79) LIEFTINCK (65).

The type is a ♀ from 'Java', the allotype being described by me after a specimen taken by FRUHSTORFER in southwest Java, now in the Brussels Museum. A small species, hitherto only known from the low mountains of the Djampangs in West Java where it is possibly not uncommon locally. A few other specimens in the Senckenberg Museum (formerly RIS's collection) bear the locality-label 'Soekaboemi', but the only definite locality where it is found is the Djampang district. I possess three ♂♂, taken by native hunters on Mt. Tjisoeroe, Djampang Tengah, 600 m, June 1932, and Jan. to March, 1933 (III).

In 1934, on July 11, I found a nymphal skin of possibly this species, attached to the underside of a big stone in a forest-stream near Bantarpeundeuj, 400 m alt., 15 km north of Pameungpeuk (IV).

109. **Macromia westwoodi** SELYS (111) LIEFTINCK (65).

Locally common and probably universally distributed in the damp forests of the lower mountain zone. Occurs also in Malaya, Banka and Borneo, but not so far reported from Sumatra. I have studied two ♀♀, labelled 'Soekaboemi', which in all probability came from Mt. Tjisoeroe or Mt. Halimoen, in the Djampang districts. These are the only West Javan specimens known to me.

Apparently quite a common insect in the forests on the southern slope of Mt. Slamat, from where I have received over hundred specimens, all caught by DRESCHER and his assistants. Breeds in forest-pools and roadside brooks and is in flight the whole year round. The copulation was observed in October, but it is almost certain that oviposition takes place at any time of the year. A single full-grown larva was found in a rice-field by Mr. DRESCHER, July 9, 1929, but nothing definite is known on the habits and life-history of this fine species.

West Java: Two ♀♀, 'Soekaboemi' (purchased from Mrs. WALSH); one ♀, Mt. Tjisoeroe, Djampang Tengah, 600 m, May 1934 (III).

Mid Java: Numerous specimens, Mt. Slamat, Batoerraden, 850 m, all the year round, DRESCHER (VII).

East Java: One ♀, Mt. Raoeng, Bajoekidoel Est., 500 m, May-June 1931, LUCHT (XX).

110. **Epophthalmia vittata sundana** LIEFTINCK (69).

The Malaysian race of the Indian *vittata* is still only known to me from West Java, where it appears to be commonly distributed in low country. The males are most brilliantly coloured insects of great size and may be seen patrolling the sunny borders of weedy tanks, fish-ponds and lakes. Their flight is extraordinarily swift and low over the water's surface, and each male's beat covers a distance of many yards. It is seen over the water only in the morning hours, from 9 to 12 a.m., disappearing as soon as the sky clouds over. For notes on egg-laying habits, flight and details of life-history see the writer's general treatment of the genus.

111. **Epophthalmia vittigera** (RAMB., 82) SELYS (110) MARTIN (78, 79) RIS (85, larva) FRASER (31) LIEFTINCK (69).

Widely but sparingly distributed from sea-level upwards to an altitude of 1400 meters. Breeds in still waters, the males frequenting the sunny borders of large ponds and lakes. I have observed this giant species on various occasions, flying rapidly some six ft. above the surface of deep water, but I never succeeded in capturing any myself. Only solitary males are seen on the wing, the females apparently having retiring habits and only come to the water to oviposit. Found throughout the year. The larva was described by RIS and in the author's previous paper on the genus.

West Java: Batavia (II) Depok; Tjiseëng; Buitenzorg; Tjigombong; Mt. Gedeh, Sitoe Goenoeng, 1000 m, April and Tjibodas, 1400 m, Sept.; Mt. Tjisoeroe, Djampang Tengah, 600 m; Lake Njalindoeng, 900 m (III) Lake Padalarang, 650 m; Garoet, in town, 800 m (IV).

East Java: One ♀, labelled "Java or., MULIÉ", in the Leiden Museum.

Fam. CORDULEGASTERIDAE.

112. **Chlorogomphus magnificus** SELYS (97, 98, 100, 101, 122) KRÜGER (52) FRASER (31, 36) SCHMIDT (92).

Confined to the lower mountain forests of West and Mid Java. Very rare. By its large size, its great scarceness and striking colours, this insect is no doubt one of the most interesting among regional dragonflies. The history of *magnificus* is as follows. The brilliantly coloured ♀ was described by DE SELYS in the Synopsis as early as 1854, along with the unique ♂, both forming part of the Leiden Museum collections. The only examples of *Chlorogomphus* s.str. known to SELYS were the ♂ and ♀ types in the said Museum, and ♀♀ of uncertain origin, but probably from Java, in his own collection and that of HAGEN. Al-

though in the Monograph (1858) SELYS was inclined to think that the ♂ and the ♀♀ might belong to different species, the name *hyalinus* for the ♂ appears for the first time in the 2nd additions to the Synopsis, in 1869. While he may have intended to mention *hyalinus* ♂ in 1859 but failed to do so, he did not consider it necessary to give a fresh description of this ♂ because a diagnosis of the ♂ had been given already in the Synopsis 1854, and a full description and figures in the Monograph 1858, and SELYS himself in his list of 1873 (3rd addit.) gives the Synopsis 1854 as the place in which the description of *hyalinus* is to be found. Early in 1928, I have examined the fragments of the ♂ holotype, which now consists only of four wings and abdominal segments 1-7; this ♂ bears a printed label "MÜLLER, Java", the ♀ allotype being labelled "Sumatra". The terra typica of our species thus is Java and Sumatra, not Sumatra only, as has erroneously been stated by SELYS and various subsequent writers. FRASER (1929) gave a wing-photograph of the type but the ♂ itself remained unknown to him. The late F. RIS informed me that SCHMIDT's specimen, which was used for dissection purposes in his paper of 1912, was taken in 1892 by FRUHSTORFER on Mt. Gedeh in West Java. Until recently this was the only authentic ♂ of Java.

The habits and life-history of *magnificus* are still shrouded in mystery. Some of the better known species have the habit of soaring slowly in wide circles over dense jungle at the source of rivers, or over ravines and forest roads, usually at considerable heights. Of Indian species it is stated by FRASER that the copulation takes place sometimes a long way from the breeding grounds, the female seeking these out afterwards and oviposits unaccompanied by the male. The males are very much alike *Macromia* in flight, for which they have often been mistaken. Like other members of the genus, *magnificus* probably breeds in mountain streams near their source and the larva may be found buried deep in the sand at the foot of miniature waterfalls in moderately deep pools. At transformation it clings to trees or to rocks alongside the stream. The larva of Indian *campioni* has habits quite similar to *Cordulegaster*. Beside the type specimens and a few ♀♀ lacking further indications of habitat, the following material has been studied by me.

W e s t J a v a: Six ♀♀, Mt. Halimoen, 500 m, April 18, June and July-Aug., 1927, native coll.; Mt. Tjisoeroe, Djampang Tengah, 1932, idem; two ♂♂, Mt. Gedeh, Tjiboenar Est., near Perbawatie, 1000 m, Nov. 8, 1929, idem, DRESCHER acq. (III) One ♀, "Preanger", in Mus. Leiden (IV).

M i d J a v a: One ♀, Mt. Slamat, Batoerraden, 850 m, Nov. 24, 1928, DRESCHER (VII).

Fam. GOMPHIDAE.

113. **Ictinus decoratus** SELYS (97, 122) (BURM., 9) CALVERT (10) LAIDLAW (60).

Fairly common throughout the year in low country and almost universally distributed in the plains of West and Mid Java. It is both a rapacious and pugnacious dragonfly, prying upon all kinds of insects and pursuing even such large dragonfly species as *Anax* and *Epophthalmia*.

Quite common in the Botanic Garden of Buitenzorg. The males are never seen away from the neighbourhood of water and may be seen perched on prominent twigs around the border of ponds and lakes, or near the banks of canals. Rests with horizontally outspread wings and with the solid abdomen held stiffly and straight out. From such coign of vantage they keep a sharp look-out, indulging in short and swift beats up and down the border of a tank, always however returning to the original resting place. The ♀ often wanders far from water and rests on dead twigs, railings or telegraph-wires. Like *I. melaenops,* it breeds exclusively in stagnant waters, although in Tjisolok I once observed the oviposition in shallows along the banks of a small sunny stream. Pairing takes place over water and is of very short duration. The ♀ oviposits unaccompanied by the ♂ and this is performed by swift dips of the abdomen, few eggs being released at each stroke.

The larvae are bottom-dwellers whose legs are adapted for burrowing in the mud; they feed principally on *Orthetra-* and ephemerid larvae, worms and snails, which are rummaged out in large quantities, but only at night. At transformation the larva crawls to large stones, or drift-wood along the borders of a pond. On lake Tjigombong I found numerous cast skins on the leaves of *Eichhornia,* ferns and submersed stems of sago-palms, just above water mark.

West Java: Common.

Mid Java: Djeroeklegi, plain country; Poerwokerto; Mt. Slamat, Batoerraden, 850 m, all the year round (VII).

East Java: Bondowoso (XX).

In 1929, on June 1, Mr. DRESCHER captured a male near Talangpadang (foot of Mt. Tanggamoes), in the southern Lampong district, S. Sumatra. This is the only Sumatran specimen of *decoratus* which I have examined; it agrees in all respects with Javan specimens.

114. **Gomphidia javanica** FÖRSTER (20) KRÜGER (52) LAIDLAW (60).

Originally described from a single ♂ collected by PAGENSTECHER near Malang. Very rare, but apparently well distributed in wooded country over the entire island. Confined to Java. The genus is closely allied to *Ictinus* and its members have similar habits. *G. javanica* is a shade-loving species. The ♂ from Mt. Raoeng was caught in a gloomy bamboo-grove, settled high on the branch of a tree overhanging a small brook, and after being dislodged returned to the original spot time and again. Life-history and larva unknown.

In the Brussels Museum is a fine series of males taken by FRUHSTORFER, probably in southwest Java, and a ♂ from Pengalengan. KRÜGER also has seen five ♂♂ from the island.

West Java: Two ♂♂, Mt. Tjisoeroe, Djampang Tengah, 600 m, Febr.-March 1926 and Nov. 1932, native coll. (III) One ♂, Pengalengan, 1300 m (?), 1893, FRUHSTORFER, in Mus. Brussels (IV).

East Java: One ♂, Malang, PAGENSTECHER (FÖRSTER) (XVIII). One ♂, Mt. Raoeng, Bajoekidoel Est., 500 m, Nov. 23, 1932, TOXOPEUS (XX).

115. **Megalogomphus icterops** (MARTIN, 77) LAIDLAW (60).

Described from a ♂ in the Paris Museum, collected in Java. In the Brussels Museum are two ♂♂, whose colour-patterns and measurements are exactly identical, the one coming from Borneo (Sarawak), the other from Java, captured by FRUHSTORFER. With MARTIN's, this is the only male known from the island. Species of this genus are given by FRASER to breed in small mountain streams, the habits closely resembling those of *Ictinus*, for which they may be mistaken when on the wing or resting.

116. **Megalogomphus junghuhni** LIEFTINCK (75).

Only a single ♀, with a locality-label 'Java, HEYNE' is known of this fine insect. It is the largest and possibly one of the rarest Gomphids known from the island.

117. **Onychogomphus banteng** LIEFTINCK (66) LAIDLAW (60).

Apparently also a very rare species, known only from the unique ♂ collected by W. ROEPKE on the slopes of Mt. Salak, Pandan Aroem Est., near Tjibadak, about 1000 m above sea-level, June 1916 (III). The specimen is in the author's collection.

The habits and breeding-places of the allied Indian species *nilgiriensis* FRASER have been described by him as follows: — "The insect which is very local, frequents shady mountain streams, generally those with clean gravelly bottoms and is found settled on rocks or twigs in mid stream. When disturbed it immediately rises perpendicularly to trees overhanging the stream. In Coorg it prefers streams almost entirely hidden and closed in by overhanging cane brakes where it may be found settled on rocks or on the gravelly beach or occasionally hawking to and fro over runlets or rapids to which places the female usually resorts to lay her eggs. Whilst ovipositing the female hovers some two feet or less over the stream" (29).

The larvae are adapted to a life in shallow running water and are characteristic by their flattened leaf-like body and broadened antennae.

118. **Onychogomphus geometricus geometricus** SELYS (97, 99, 122) LAIDLAW (60) LIEFTINCK (66).

The type is a ♀ in the Leiden Museum, collected in Java more than a century ago by KUHL and VAN HASSELT. Paratypes and several other specimens of old date have been examined by me in the Brussels and other Museums. They have shortly been discussed in the author's previous paper.

So far known a very scarce species, but apparently widely spread and possibly not uncommon locally in densely forested hilly regions. Breeds in streams with rapidly flowing water. The pair from Tanggeung was caught by TOXOPEUS and myself in the bush near the bridge over the Tjiboeni, which finds its way through a steep and heavily forested ravine. Habits and life-history quite unknown.

West Java: A small series by FRUHSTORFER (Mus. Brussels). One ♂, six ♀♀, Mt. Tjisoeroe, Djampang Tengah, 600 m, March, July and Oct., 1933, native coll.; one ♂, one ♀ Tanggeung, south of Pagelaran, 300-400 m, Dec. 26, 1931, AUTHOR; one pair, Wijnkoops Bay, in coll. FÖRSTER (III).

East Java: Two ♂♂, Tengger Mts., alt.?, H. FRUHSTORFER, in Mus. Brussels (XVIII).

119. **Onychogomphus modestus fruhstorferi** LIEFTINCK (76).

A small and darkly coloured insect, inhabiting large streams in wooded country. The type is a ♂ from W. Java collected by FRUHSTORFER and is now in the Brussels Museum. A second ♂ in Mus. Leiden, lacking its head, is an old specimen collected by S. MÜLLER in Java. Evidently a very rare species.

East Java: Two ♂♂, Mt. Raoeng, Bajoekidoel Est., 500 m, May-June, 1931 and Jan. 1932, LUCHT (XX).

120. **Onychogomphus thienemanni** SCHMIDT [1]).

To be reported from 'Java', leg. FRUHSTORFER (SCHMIDT, *in litt.*). Not seen by me.

121. **Mesogomphus reinwardti reinwardti** (SELYS, 97) LIEFTINCK (66, 76) LAIDLAW (60).

The material on which the first description was based, has been discussed in my 1929 paper. I have seen several other examples collected again by FRUHSTORFER in West Java. The typical race is confined to Java and seems to have a wide distribution.

Very local, but fairly common where found. Breeds in forest streams. The males sit on large rocks in mid stream or on gravel banks near its border, where their cryptic body-colouring renders them very inconspicuous. A description of its haunts and notes on the larva are to be found in the author's latest paper.

West Java: Bajah, south-coast, 80 m, Sept. 1934, M. E. WALSH (I) Buitenzorg, Botanic Garden, 250 m, Jan. 1931, along shady stream, AUTHOR; Wijnkoops Bay and Tjisolok, sea-level, common locally along small forest streams, April to June, AUTHOR; Mt. Tjisoeroe, Djampang Tengah, 600 m, 1932, native coll. (III).

Mid Java: Djeroeklegi, sea-level, Oct. to Nov., locally abundant along small brooks, DRESCHER; Mt. Slamat, Batoerraden, 850 m, June 19, 1930, a single ♂, DRESCHER (VII) Samarang, 50 m, teak-forests, June 1926, KALSHOVEN (IX).

East Java: Padangan, 40 m, July 27, 1927, VERBEEK (XV).

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[1]) This species will soon be described in "Tropische Binnengewässer", Bd. V (Arch. Hydrobiol. Suppl.-Bd. XIII).

122. **Burmagomphus inscriptus** (SELYS, 101) RIS (86, sub *jacobsoni*) LIEFTINCK (66) LAIDLAW (60).

The type of this graceful little species is a ♀, collected more than a century ago by KUHL and VAN HASSELT somewhere in the island. The ♂ was discovered by JACOBSON near Samarang and has been described and figured by RIS. I have figured the genital organs in my paper of 1929. Evidently an extremely rare species which possibly has arborial habits. According to FRASER, all species so far known are jungle inhabitants, frequenting streams in ravines in montane and submontane areas. Males are found resting on stones in the stream or on rocks or foliage beside these waters. The larvae are of the torpedo shape, resembling rather closely those of *Onychogomphus*; all are stream-dwellers. Besides the typical series, I have seen from:

East Java: One ♂, Batokan near Tjepoe, 40 m, Febr. 4, 1926, VERBEEK (XV).

123. **Burmagomphus javicus** SCHMIDT [1]).

Early in 1933, I received from Mrs. WALSH, Soekaboemi, a single ♀ of a small Gomphid belonging to an undescribed species of the *vermiculatus* group of *Burmagomphus*. By the absence of the ♂ a description of it was postponed until later. Dr. E. SCHMIDT, to whom I sent the specimen for comparison with a new *Burmagomphus* he proposed to describe from Java, now informs me (*in litt.*, Oct. 3, 1934), that the two specimens are conspecific.

The type male is from 'Java', taken by FRUHSTORFER.

West Java: One ♀, Mt. Tjisoeroe, Djampang Tengah, ca. 600 m, April 1933, native coll. (III).

124. **Macrogomphus parallelogramma** (BURM., 9) SELYS (97, 99, 101, 122) CALVERT (10) RIS (86) KONINGSBERGER (50) LAIDLAW (60).

The type, a ♀, was described from 'Java' and is figured in the Monograph. HAGEN's careful description of the ♂ is also based on a Javan specimen. Not known from the other Sondaic islands. An arborial insect, widely but sparingly distributed, chiefly in low country. Since the ♂♂ occur only rarely in the neighbourhood of water except on emergence, they are only occasionally come across, dispersing inland for long distances and resting among shrubbery or high up in trees. Breeds in sluggish streams, in sandy brooks flowing through marshes, and possibly also in canals. The larva might be found buried in the mud at the border of some stream. Its abdomen is very long and cylindrical, the end segments being produced into a siphon-like structure. This tubular organ projects from the mud or sand whilst the rest of the body is submersed and thus enables the insect to carry on rectal breathing without exposing its body (FRASER).

[1]) This species will soon be described in "Tropische Binnengewässer", Bd. V (Arch. Hydrobiol. Suppl.-Bd. XIII).

W e s t J a v a: One ♀, Tjarita, Oct. 4, 1930, along brook in coastal swamp, TOXOPEUS; one ♂ (three others seen), Malimping, April 24, 1933, in secondary growth, AUTHOR (I) One ♀, Batavia, June 1908, JACOBSON, one ♀, Batavia, both in Mus. Leiden (II) Two ♀♀, W. Java, PIEPERS, in Mus. Leiden; three ♂♂, three ♀♀, Java mer., FRUHSTORFER, in Mus. Brussels; one ♀, Buitenzorg, June 26, 1930, "in laboratory", J. VAN DER VECHT; one ♀, Buitenzorg, Batoetoelis, April 17, 1934, native coll.; one ♀, Wijnkoops Bay, in coll. FÖRSTER (III).

M i d J a v a: Three ♂♂, three ♀♀, Mt. Slamat, Batoerraden, 850 m, Nov. 24, 1928, Febr. 18-19 and Aug. 4, 1929, DRESCHER (VII) One ♂, Samarang, hilly country, March 22, 1931 "at lamp, 9.30 *p.m.*", DRESCHER (IX). One ♀, Japara, July 1917, ROEPKE (XII).

E a s t J a v a: One ♀, Java or., MULIÉ, in Mus. Leiden; one ♂, Soerabaia, Nov. 1909, P. BUITENDIJK, in Mus. Leiden (XVII) One ♀, Tjepoe, 40 m, March 26, 1926, VERBEEK (XV) One ♀, Malang, 700 m, April-May, 1929, OVERDIJKINK (XVIII).

125. **Leptogomphus lansbergei lansbergei** (SELYS, 101) FÖRSTER (23, sub *M. semiteres*) LAIDLAW (58, 60) FRASER (31, 33) RIS (91).

The type is a ♀ in the Brussels Museum, labelled 'Batavia, LANSBERGE'. Besides this, I have examined several other ♀♀ taken by FRUHSTORFER in Java. RIS's ♂ from 'Soekaboemi' came from Mt. Tjisoeroe.

Found all the year round in hilly and low mountainous regions, distributed over the entire island. It is perhaps the least rare among regional Epigomphines. Like most of the others, it has rheophilous habitats, the adults after emergence from a forest stream flying straight on to the jungle and may be found in great numbers sitting on leaves or prominent twigs on the tops of trees. Their flight is low and trailing and in the gloominess of their damp retreats the alternated colour-pattern of black and greenish yellow renders them remarkably inconspicuous. Near Leuwiliang I once caught a ♀ basking in the sunshine on the leaves of a low tree, some hundred feet above the bed of a small stream. On account of the damp situations in which it usually occurs, *lansbergei* requires a long time for the hardening of its body and wing-membrane, tenerals predominating far over the adult specimens.

The ♀ deposits her eggs in shady leaf-bottomed forest-brooks, or in small streams with large stones in the bed. *Malayogomphus semiteres* FÖRSTER, from the Wijnkoops Bay (Palaboean Ratoe) in S.W. Java is synonymous with our species.

W e s t J a v a: "Batavia, LANSBERGE" (II) Leuwiliang near Buitenzorg, 800 m; Wijnkoops Bay; Mt. Tjisoeroe, Djampang Tengah, 600 m, common (III) Koleberes, southern slopes of Mt. Patoeha, 700 m; Radjamandala, 350 m, virgin forest; 15 km north of Pameungpeuk, 400 m (IV).

M i d J a v a: Mt. Slamat, Batoerraden, 850 m, common (VII).

E a s t J a v a: Mt. Raoeng, Bajoekidoel Est., 500 m, throughout the year (XX).

126. **Microgomphus chelifer thelyphonus** LIEFTINCK (66) LAIDLAW (60).

Described and figured from two ♂♂ and one ♀ collected by FRUHSTORFER in southwest Java. Since then I received a ♂ of this race from the southern extremity of Sumatra, and a second ♂ was caught by Mr. DRESCHER on the thickly forested isle of Noesa Kambangan, in S. Banjoemas (Mid Java), April 21, 1930. Possibly distributed throughout the island at low elevations, but evidently a very scarce species.

Heretofore considered by me as specifically distinct from *chelifer*, but now placed in the same formenkreis as a subspecies. The Indian representatives, according to FRASER, are arborial by nature, but they often descend to settle on rocks in the bed of their parent streams, from which — when disturbed — they rise to the branches of trees high overhead. Settled in such situations, their shagreen colour renders them almost invisible. Flight short and swift.

127. **Heliogomphus drescheri** LIEFTINCK (66) LAIDLAW (60).

Originally described from Mt. Slamat, from where I have seen many specimens, captured in all months of the year. Subsequently discovered also in the extreme eastern part of the island. In the Brussels Museum is a single unidentified ♂ collected in southwest Java by FRUHSTORFER as early as in 1893. Occurs also in South Sumatra.

Evidently a rare species, found in similar situations as *L. lansbergei* and often taken along with it in the same place. I have described the larva of *H. kelantanensis* (LAID.), which by the curious flattening of the body is adapted to a life in very shallow water.

Mid Java: Mt. Slamat, Batoerraden, 850 m, locally fairly common throughout the year, DRESCHER (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, Jan. and April-May, LUCHT; Djember, Jan. 1933, LUCHT (XX).

Messrs DRESCHER and TOXOPEUS have taken this species, along with several other Epigomphines, in the primeval forests of the Lampong district in South Sumatra (Talangpadang and environs). These Sumatran specimens differ in no way from our typical series. *H. gracilis* (KRÜGER) is a second Sumatran species.

Fam. AESCHNIDAE.

128. **Amphiaeschna ampla** (RAMB., 82) (HAGEN, 41) KARSCH (46) MARTIN (80) FRASER (31).

RAMBUR's type is a ♀ in the Brussels Museum in very poor condition, lacking most of the abdominal segments. FRUHSTORFER collected five ♂♂ and six ♀♀ in Java which are placed in the same collection. Terra typica unknown, but very probably Java and so far not recorded outside the island, though MARTIN gives Tonkin as a further habitat; his wing-photograph of a ♀ is taken from this species, not from *grubaueri* (= *perampla*). The figures of the ♀ ter-

minal appendages in FRASER' s account on the two species should be transposed, and the indication 'Buitenzorg' as a habitation of *A. ampla* is erroneous.

Moderately common in densely forested, mountainous areas and distributed over the entire island. It is a very local species and apparently quite abundant in suitable places. So far as I know all specimens were beaten up during the day from beneath dense shade at the bottom of deep narrow ravines where both sexes may be found hanging on branches among the foliage, or sitting against the bark of a tree, often in considerable numbers. It is never seen on the wing by day and may have particularly crepuscular or nocturnal habits. The breeding-places are unknown, but the larvae may reasonably be expected to live in small muddy pools at the edge of a stream.

West Java: Mt. Gedeh, Tjiboenar Est. (Perbawatie) 1000 m; Mt. Halimoen, 600 m; Mt. Tjisoeroe, Djampang Tengah, 600 m (III) Mt. Tangkoeban Prahoe, 14-1600 m, throughout the year (IV).

Mid Java: Mt. Slamat, Batoerraden, 850 m, all the year round (VII).

East Java: Mt. Raoeng, Bajoekidoel Est., 500 m, Jan. 1932 (XX).

129. **Indaeschna grubaueri** (FÖRSTER, 21) (MARTIN, 80) FRASER (31).

For the reception of this species FRASER has proposed the generic name *Indaeschna,* and although *A. ampla* resembles *grubaueri* in many essential points, I think we are right following him. FÖRSTER described the ♂ from the Malay States, MARTIN gave a diagnosis of both sexes under the name *perampla,* and FRASER described a ♀ from Sumatra, erroneously stated to come from Java.

The only specimen known as having been collected in Java is a male (head wanting) in the Leiden Museum, labelled "MÜLLER, Java"; it was identified by R. MARTIN as *'Amphiaeschna perampla* SELYS'. I have also examined MARTIN's type of *perampla* from 'Malaisie', which is identical with *grubaueri* FÖRST. Several specimens from Sumatra and Borneo have since come under my notice. Habits and life-history unknown.

130. **Tetracanthagyna brunnea** MCLACHLAN [1]) (? = *degorsi* MARTIN).

One of the latest, and at the same time most striking additions to the Javan Aeschnid fauna. *T. brunnea* was described from North Borneo by MCLACHLAN and KRÜGER; the male is unknown. MARTIN's *degorsi,* founded on a single male from Nias, and also reported from Borneo, might be identical with *brunnea,* and in that case the latter becomes a synonym of *degorsi.*

Species of this genus have nocturnal habits and are only occasionally found. So far known, they breed in forest marshes and deep pools, taking the shelter of dense foliage.

Dr. LAIDLAW once took a female of *brunnea* in Kelantan, northern Malay Peninsula, which was fluttering about the trunk of a large forest tree.

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[1]) R. MCLACHLAN, Considerations on the genus *Tetracanthagyna.* Trans. ent. Soc. London, 1898, pt. 4.

West Java: One ♀ (adult), Mt. Tjisoeroe, Djampang Tengah, ca 600 m alt., May 1934, M. E. WALSH misit. (III).

131. Heliaeschna uninervulata MARTIN (80).

New to Java. Originally described from Borneo and Enggano Is., off the west-coast of Sumatra. I have seen both sexes from Borneo and a ♂ from Sumatra. The ♀, which is as yet undescribed, has a three-pronged anal plate. The members of this genus have exclusively nocturnal habits. The larva is similar to *Gynacantha* but more robustly built. Hitherto only known from Mid and East Java, whence I have seen the following material.

Mid Java: Three ♂♂, one ♀, Ambarawa, LUDEKING, unidentified in Mus. Leiden (IX).

East Java: One ♂, Malang, HILLEBRAND, determined by RENÉ MARTIN in Mus. Leiden (XVIII).

132. Gynacantha basiguttata SELYS (114) KRÜGER (52) FRASER (31) LIEFTINCK (68).

Previously only reported from the island by KRÜGER and FRASER, I have examined the two ♂ types, labelled "Borneo W. K.", and the ♀ from Luzon, all in the Brussels Museum. The species has a wide distribution outside Java, but is a rare insect in our island. Inhabits damp primeval jungle in low country where it may be sought for during the whole year. Like other species of the genus it is nocturnal in habits. Breeds probably in forest pools. Larva unknown. Apparently common on Noesa Kambangan.

West Java: One ♀, Bajah, south-coast, 80 m, Sept. 1934, M. E. WALSH (I) One ♀ (ad.), Buitenzorg, March 22, 1920, TYPE of *G. javica* FRASER, in Mus. Buitenzorg; one ♂, one ♀, Mt. Tjisoeroe, Djampang Tengah, 600 m, Febr.-March, 1926 and May 1933, native coll.; one ♂, Wijnkoops Bay, Dec. 1932, idem (III).

Mid Java: Seven ♂♂, one ♀ (in cop., Jan. 17, 1928), isle Noesa Kambangan, sea-level, May, June, July, Dec. 1927, Jan. and Nov. 1928, DRESCHER (VII).

133. Gynacantha bayadera SELYS (p.p. 117) RIS (emend. 85, 89) KRÜGER (52) FRASER (31, sub *millardi*) LIEFTINCK (68).

Reported from Java by KRÜGER and RIS. MARTIN's figure of the ♂ anal apps., in the Monograph, was made after a different species (*ex* Palone, Birma). For synonymy see: RIS (89) and LIEFTINCK (68).

Fairly common and distributed all over the island in wooded districts, from sea-level upwards to about 1500 m. Chiefly found in mountainous areas. I have often come across this fine insect in thin forest, where it may be beaten up from its shelter among the leaves. Its delicate grass-green colours are highly cryptic in nature. *G. bayadera* has exclusively crepuscular habits, flying only at dusk. On Mt. Tangkoeban Prahoe, Mr. DRESCHER saw great numbers flying

in a cinchona plantation at about sunset. Males are attracted to light, and on various occasions it has been observed indoors and in verandahs at dusk. Breeding-places unknown.

West Java: Buitenzorg; Tjiampea; Tjiomas; Leuwiliang, 800 m; Mt. Salak, 800 m; Mt. Halimoen, 500 m; Mt. Gedeh, Tjisaroea Est., 1000 m; Mt. Tjimerang and Mt. Tjisoeroe, Djampang Tengah, 400-600 m; Wijnkoops Bay, Tjisolok (III) Mt. Tangkoeban Prahoe (IV).

Mid Java: Djeroeklegi and isle Noesa Kambangan, sea-level; Mt. Slamat, Batoerraden, 850 m (VII).

East Java: Java or., FRUHSTORFER (RIS, l. c.); Idjen Plateau, Kendeng, 1200 m; Mt. Raoeng, Bajoekidoel Est., 500 m (XX).

134. **Gynacantha dohrni** KRÜGER (52) MARTIN (80).

This is evidently a very scarce species in Java. For his description KRÜGER disposed of two ♂♂, from Sumatra and Java, and a small series from North Borneo. *G. dohrni* has often been confused with *G. basiguttata* by subsequent writers, a ♂ from southwest Java collected by FRUHSTORFER in the Selysian collection figuring alco under that name. While going over the material in the Brussels Museum, I have convinced myself further of MARTIN' s figure of the ♂ apps. of *basiguttata* being made from a specimen of *dohrni,* collected near Bukau in North Borneo. On Java, the island Noesa Kambangan is the only precise locality for this species.

Mid Java: One ♂, one ♀, isle Noesa Kambangan, June 1, 1927 and April 1, 1929, both captured by DRESCHER (VII).

135. **Gynacantha limbalis** KARSCH (46) MARTIN (80).

Originally described from Java, but never found back again. Of late, LAIDLAW has reported it from Borneo and, questionably, from Perak. Doubtlessly a very scarce species.

136. **Gynacantha musa** KARSCH (46) MARTIN (80).

Terra typica Java. Although seemingly not uncommon locally in low mountainous regions throughout the island, not yet found elsewhere. Closely related to *basiguttata,* yet easily distinguished in the male sex by the truncated apex of upper anal appendages. In the Brussels Museum I have seen three ♂♂ collected by FRUHSTORFER in southwest Java, and a ♂ from Flores taken by the same. These specimens have so far remained unidentified but were placed (evidently by MARTIN) under *basiguttata.*

Found throughout the year in wooded districts. On Mt. Karang I took a ♂ hovering over a small leaf-bottomed pool in second growth wood.

West Java: One ♂, Mt. Karang, Djoehoel, 400 m, May 26, 1931, AUTHOR (I) Many specimens, Mts. Tjisoeroe and Tjimerang, Djampang Tengah, 400-650 m, Jan.-July, native coll. (III).

M i d J a v a: One ♂, Tjilatjap, sea-level, Aug. 9, 1928 and numerous specimens, Mt. Slamat, Batoerraden, 850 m, Jan., April to Aug., DRESCHER (VII).

E a s t J a v a: Two ♂♂, four ♀♀, Mt. Raoeng, Bajoekidoel Est., 500 m, May-June, Sept.-Oct. and Dec., LUCHT (XX).

137. **Gynacantha subinterrupta** (RAMB., 82) HAGEN (40) SELYS (116) KRÜGER (52) MARTIN (80) RIS (87, 89) KONINGSBERGER (50) FRASER (31).

RAMBUR's type, a ♂ in perfect condition, is in the Brussels Museum, but I have failed to recover his ♀ which is apparently lost. Described and figured by RIS from specimens of East Java (FRUHSTORFER). The thorax is olive-green and the pale abdominal spots of the adult male are b l u e and g r e e n in living examples, not brown as was repeatedly stated by RIS.

This is by far the commonest Javanese *Gynacantha,* occurring everywhere in plain country as well as in mountainous areas. Highest recorded altitude: Mt. T. Prahoe, ca. 1300 m (one ♀) and common on Mt. Slamat, 850 m. *G. subinterrupta* is in flight during the whole year and has nocturnal habits. The first individuals appear on the wing about half an hour before dusk falls, leaving their resting-places and commence a rapid skipping flight in the open. About thirty minutes before sundown, at 6.15 *p.m.* in the wet season, it may commonly be seen hunting for mosquitos in the darkened verandahs of bungalows, in forest-clearings, over road-side brooks, etc. As twilight comes the insects quickly augment to form small flocks and continue their flight in dark situations, e.g. muddy ditches and among pools under the banks of some small stream, where both sexes skim the surface of the ground, stuffing themselves with immense numbers of mosquitos. In such places, as night has set in for good, they may only be captured by watching for their silhouette.

The oviposition was observed by me in wet earth under the overhanging bank of a shallow pool near Tjisolok (Wijnkoops Bay); in the Karimoen Djawa islands, where this species is very abundant, I have watched several females ovipositing in the wet soil of a mangrove-pool, just before sunset. Few females are taken with the tiny anal appendages whole, these having been fractured off during the process of egg-laying, or are gnawed to pieces by the male during copulation. In a forest marsh near the Wijnkoops Bay, I caught two females in the act of transformation at 10 *a.m.*, the exuviae hanging on semi-aquatic plants, few inches above water-level. Sometimes, however, the larvae form burrows or canals in the mud of a ditch or dry pool, and on emergence ascend a convenient reed-stem or stick. Obviously in sign of their forest-loving habits, specimens taken at light in the evening show the white threads of cobwebs attached to their wings, and numerous specimens beaten up from their shelter during the day bear equal witness of their escape from spider's webs. Mr. BENNER once took a pair in copulation in the verandah of his house in Tjilatjap, coming to light at 8 *p.m.*

138. **Gynacantha stenoptera** LIEFTINCK (75).

Described from a single ♂ in the Leiden Museum, collected in Java by some unknown explorer. It is most closely related to *G. subinterrupta.*

139. **Anaciaeschna jaspidea** (BURM., 9) SELYS (116) CALVERT (10) MARTIN (80) KONINGSBERGER (50) FRASER (31).

The type is one of a series of females, collected in Java.

Chiefly a species of low country, but observed upwards to as high a level as 1400 m above the sea. On account of its crepuscular habits, *A. jaspidea* is not often come across, though extremely abundant where found. It has a wide distribution throughout Java.

Although the females at least may have also diurnal habits, both sexes usually appear on the wing in the late afternoon and then assemble to large flocks which suddenly appear over rice-fields (s a w a h' s) and meadows, flying some 10 feet above the ground. Their flight is not so erratic as in *Gynacantha*, and at times the insects are an easy capture. Apparently, their flight is continued until long after dusk and obviously also during the night for many individuals have been captured in houses where they came to the lamp as late as 11 *p.m.* Mr. DRESCHER once took a series of 24 males and an equal number of females in a meadow near his house in Bandoeng (Aug. 27, 1928) and I have myself caught solitary specimens at light about 9 *p.m.* in Buitenzorg as well as on Mt. Gedeh, at an elevation of about 1000 meters. On Dec. 17, 1930, DRESCHER took a pair *in cop.*, coming to light in the verandah of his bungalow in Djeroeklegi (S. Banjoemas).

Jaspidea breeds in rice-fields and marshes. Transformation takes place during the night or in the early morning, and I found a few individuals emerging in a paddy field near Pasaoeran (W. Bantam) about 9 *a.m.* It is in flight during the whole year.

140. **Anaciaeschna montivagans** LIEFTINCK (71).

A mountain species, not occurring below 1200 m and even found at altitudes of over 2500 m. Widely but sparsely distributed throughout the higher mountain districts of West and Mid Java and a common insect in suitable places. It is on the wing in all seasons of the year, and, as is cleary demonstrated by my records of larvae and adult females captured during the act of oviposition, there appears to be a continuous succession of broods. In the peat-marsh Telagasaät (Poentjak-pass) larvae in all different stages of development may be found at any time of the year, the egg-laying females having been caught on March 30, April 19, May 18, June 19, Aug. 24, and Dec. 15 (West Java only).

A. montivagans breeds in mountain-swamps, forest-pools and marshes. On Mt. Papandajan the oviposition was observed by Mr. VAN STEENIS in partially submersed stems of *Juncus prismatocarpus*, at 1 *p.m.* (May 18, 1931). In the peat-marsh Telagasaät solitary females were observed by me ovipositing in

Polygonum javanicum, 10-11 *a.m.* (Dec. 15, 1929 and Aug. 24, 1930) and on Mt. Panggerango in the stems of *Araceae* and *Commelina*, about 12 *a.m.* (April 19, 1930 and June 19, 1932). It is proposed to give a detailed account on the life-history of this species in a separate memoir to be published elsewhere.

Although numerous males were bred from larvae kept alive in the laboratory at Buitenzorg, the adult male has never been discovered and its hiding places remain completely unknown. In a previous paper, I suggested that it might have crepuscular or nocturnal habits, a conjecture originally shared by FRASER, who neither succeeded in tracing the adult ♂ of the related Indian species *A. martini* (SEL.). Recently, however, FRASER told me in a letter that he had at long last secured two males of that species on two successive days, in the Annaimallai Hills (S. India). The one was flying high in the bed of a mountain river and the other along a mountain road at the upper margin of forests above pools and a lake in which he had taken the females ovipositing. The evidence thus brought forward of the insect being in flight during the day, affords great interest, although FRASER found it an extraordinary coincidence after searching everywhere for it for the past 12 years.

A. montivagans is most closely allied to *martini* (SEL.) and *moluccana* LIEFT., but differs from both by its sombre colours. The ♂ anal appendages are very similar to those of *martini*, but the brightly coloured stripes on each side of the thorax of the latter will serve to its easy recognition.

141. **Anax gibbosulus** (RAMB., 82) HAGEN (41) KRÜGER (52) RIS (83, 87; 91, sub *fumosus*) LIEFTINCK (73).

Terra typica Australia. Reported from Sumatra, Java and Soemba by KRÜGER, who has given a very clear explanation of the systematics of *gibbosulus*. RIS also gives Sumatra and Java as a habitat, but the specimens examined by him are injustly referred to *fumosus* HAGEN, which is a distinct species. In his 1900 and 1913 papers, RIS has definitely ascertained the specific value of *gibbosulus* versus *guttatus*. His ♂ from 'Soekaboemi', mentioned in 1927, came from Mt. Tjisoeroe. *A. gibbosulus* and its races are at a glance distinguished from *guttatus* by the strongly pinched and much longer 3rd abdominal segment, by the presence of a T-mark on frons, the different anal apps. of the ♂, and by the absence of a middle spot alongside segm. 3-7 of abdomen. The races are distinguished from each other by differences found in the wing-neuration, and the breadth of the hind wing, by the development of the frontal patch, the size and shape of the abdominal side-spots, and by their anal apps. A rich material is needed for the definition of a number of races, which may preliminarily be arranged as follows:

A. gibb. gibbosulus (RAMB.). — Australia, Kei Is., Aroe Is., Lesser Sunda Is., Ceram (?) New Guinea (?).

A. gibb. panybeus HAGEN. — Celebes.

A. gibb. subspec. — Sumatra and Java.

The last mentioned race, which I thought to be specifically distinct from *gibbosulus* (l. c., 1933), I now consider to belong within the formenkreis of that name.

Hitherto only known from West Java, where it seems to have a scattered distribution in wooded country. It is easily distinguished from *guttatus* in flight by its dark colouring.

I have first met with this insect early in May 1932, during a short holiday-trip to Tjipanas, some 15 miles west of Wijnkoops Bay. Tjipanas (l i t t. hot river) at an elevation of ca. 50 meters, is reached by a forest path along the river of that name. The forest begins about half a mile north of the coastal village Tjisolok, and following the path, one reaches an open sunny space surrounded by dense original growth forest where the river takes up a smaller tributary. We arrived at Tjipanas early in the afternoon of May 1, and camped that night in a native bathing-house on the river bank. Here the streams enclose a grassy peninsula with much vegetation to and overhanging the gravel banks, and in the centre is a low swampy spot. In the afternoon several large *Anax* were seen flying back and forth over the bushes near our camp at too great a height for our nets. At about 4 *p.m.* they were seen patrolling the path along the river, but two hours later most of the *Anax* had apparently assembled in flocks, passing back and forth in pursuit of insects, very much after the manner of night hawks, over the grassy plain in front of the bathing house. As twilight came, between 6 and 6.30 *p.m.*, they flew nearer and nearer the ground until shortly before dusk scores of them were seen very rapidly skimming the heads of low grass, and stuffing themselves with small diptera settling to the earth at sundown. Once, a male was seen capturing a stray Pierid and a second took a large *Melanitis* in flight, devouring all but its wings. On the morning of April 15, 1933, Dr. TOXOPEUS and myself made our camp again in the same locality and managed to secure eleven specimens of both sexes shortly after sunset. As distinguished from *Gynacantha,* which has truly nocturnal habits, our *gibbosulus* disappeared soon before night had set in for good. Early next morning a teneral female was taken at transformation in a small forest-pool at some distance of the river bank.

W e s t J a v a: One pair, Bajah, south-coast, 80 m, Sept. 1934, M. E. WALSH and one ♂, one ♀, "Bantam", March 1933, WALSH misit. (I) Tjipanas (Wijnkoops Bay), May 1-2, 1932 and April 15-16, 1933, common, AUTHOR; one ♀, Tjoeroeg Goöng, Zand Bay, July 1929, DOCTERS VAN LEEUWEN; one ♂, one ♀, Mt. Tjisoeroe, Djampang Tengah, 5-600 m, May-June, 1932, native coll. (III).

142. **Anax guttatus** (BURM., 9) CALVERT (10) KARSCH (46) HAGEN (41) KRÜGER (52) NEEDHAM (81) FRASER (31) MARTIN (80) RIS (86) LIEFTINCK (67).

Terra typica Java. Widely and commonly distributed over the whole island, from sea-level upwards to considerable altitudes (Mt. Tangkoeban Prahoe, 1700 m, Mt. Gedeh, 1500 m). Our knowledge of the habits of this big species is

rather fragmentary, but it indicates that *guttatus* is very active during the day and is probably less crepuscular than *gibbosulus*. It breeds in small weedy ponds, marshes, lakes or 'tambaks' (fish ponds), round which the males are often to be seen hawking in bright sunshine, or restlessly searching for females. When flying over the water, the abdomen is held slightly in a curve, the bright blue eyes, green thorax and spotted abdomen making it quite conspicuous and easily recognizable from other large dragonflies.

In Java *guttatus* is on the wing during the whole year, but usually only solitary males are seen over the same pond. Sometimes a number of males may be seen soaring high and wide over dense jungle all day; capturing mayflies, small beetles and butterflies; in the late afternoon they all come down pursuing a flight over open country, lanes and forest-paths.

In the Karimoen Djawa islands the species was very abundant during November in small paddy-fields, pairing and oviposition taking place freely in the middle of the day; in the afternoon few specimens were seen over the forest, but just before sunset considerable numbers were again present, hawking very low to the ground on the skirts of the forest.

The larva is found among aquatic plants, i. e. *Ceratophyllum, Hydrilla* etc.; it has been described by NEEDHAM and myself. The young larvae grow rapidly and the entire life-history is completed within few months. Mr. DRESCHER once took a male of *guttatus* capturing a specimen of *Orthetrum sabina* in flight, and I have actually observed males preying upon white Pierids.

APPENDIX.

Doubtful records.

Vestalis amoena SELYS. — The type is a very old male from DE CHARPENTIER's collection, and is said to come from Java, but this is doubtlessly incorrect and probably due to a confusion of labels. See also SELYS (121), HAGEN (43), WILLIAMSON (126), and FRASER (35).

Anax papuensis (BURM.). — Only a single female, apparently collected by FRUHSTORFER, is recorded by KARSCH (46) from Java. I have omitted this Australian species from the list because of its strong migratory habit. It can only be a casual visitor of our island.

Species incertae sedis.

Caconeura lansbergei (SELYS, 115). — Described from a single male, collected by VAN LANSBERGE (?), possibly in Borneo. It is a black-and-blue species, and, according to SELYS, is allied to *C. dorsalis* (SELYS). A single female from Java, presumably referred to *lansbergei*, was described by FÖRSTER; the body is black with rich blue colouring on head, thorax and first abd.-segments (19). I am wholly unable to locale this species.

Parathemis metallica FRASER (31). — It is impossible to say, from the description alone, what this species exactly may be. *Parathemis* is said by its creator to be a close ally of *Pseudagrionoptera*, following that genus in the natural order. The male only has been made known, which is stated to be from Java. This is unlikely. Recently, Mr. D. E. KIMMINS (British Museum), informed me in a letter that the type is not in the B. M. collection. As no more dragonfly of that name is in the Buitenzorg Museum collection, the insect must be considered as lost.

Species delendae.

Vestalis lugens SELYS. — Erroneously recorded from Java by KONINGSBERGER (50). Should be *V. luctuosa* (BURM.).

Rhinocypha tincta (RAMB.) — Wrongly stated by FRASER to be a Javan insect (31). *Rhinocypha io* FRASER, described in the same paper from Sumatra, is synonymous with *R. selysi* KRÜGER.

Argiolestes karnyi FRASER (31). — Identical with *A. cincta* SELYS. FRASER'S type is from Celebes and was wrongly given to be from Java.

Teinobasis gracillima FRASER (31). — Identical with *T. superba* (SELYS). FRASER' s type comes from Celebes, not from Java.

Aciagrion occidentalis LAIDLAW. — Erroneously stated by FRASER to occur in Java (31).

Nesoxenia lineata SELYS. — Likewise erroneously reported from the island by the same author (31).

Lathrecista asiatica pectoralis (BRAUER). — Should be *L. a. asiatica* (F.). The subspecies *pectoralis* BRAUER occurs in the Moluccas (FRASER, 31).

Orthetrum leptura (BURM.) — Synonymous with *O. sabina* (DRURY). Both names figure in FRASER' s list (31).

Orthetrum pruinosum schneideri FÖRSTER. — A male labelled "W. Java, Preanger 15-1600 m, SIJTHOFF" (in SNELLEN' s handwriting), figuring under the name *O. p. clelia* SELYS in RIS' s monograph, is evidently wrongly labelled. The specimen was very probably collected in Borneo, along with several other species not occurring in Java, which are placed in the Leiden Museum, all bearing the same wrong locality-label. These species are: — *Vestalis amoena* SEL., *Euphaea inequipar* SEL., *E. subcostalis* SEL., *Rhinocypha humeralis* SEL., *Rhinagrion borneense* (SEL.), *Caconeura hyperythra* (SEL.), *Gomphidia* cf. *maclachlani* SEL., and *Leptogomphus coomansi* LAID. The Calopterygids (s. lat.) bear an identification-label in the handwriting of R. MARTIN.

Orthetrum triangulare melania SELYS. — This species has been reported from Palaboean (Wijnkoops) Bay in S. W. Java by FÖRSTER (23). The statement is certainly incorrect.

Rhyothemis resplendens SELYS. — Erroneously recorded from Java by FRASER (31). This species is restricted to the eastern part of the Archipelago.

Tramea limbata (DESJ.) and *euryale* SELYS. — These two species were held apart by FRASER in his list (31) and should be united under the name *T. limbata euryale* SELYS.

Procordulia karnyi FRASER (31). — As has been pointed out by me (68), *karnyi* is a synonym of *sumbawana* (FÖRST.).

Idionyx dohrni KRÜGER. — Erroneously stated by FRASER (31, 32) to occur in Java.

Gynacantha javica FRASER (31). — The type is a female, collected near Buitenzorg, March 22, 1930. It is in bad condition and should be classified as *G. basiguttata* SELYS (68).

Gynacantha millardi FRASER (26). — Also incorrectly listed as a Javan species by FRASER (31). Should be *G. bayadera* SEL.-RIS. *G. millardi* FRASER is an Indian species, not inhabiting Malaysia (68).

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A LIST OF THE ODONATA KNOWN FROM JAVA.

(An undulating line means that the species is known from Java but that exact localities are not recorded).

	Malaya	Sumatra	Java: West	Java: Mid	Java: East	Borneo	Celebes	Less. S. Is.	Remarks [1])
Calopterygidae									
Neurobasis chinensis (L.).	—	—	—	—	—	—		?	
N.ch. florida (Hag.).			—	—	—	?		?	
Vestalis luctuosa (Burm.).		—	—	—	—				
Euphaeidae									
Euphaea variegata (Ramb.).		—	—	—	—				
Dysphaea dimidiata Selys.	—	—	~	~	~	—			(Incl. *D. limbata* Sel.)
Libellaginidae									
Rhinocypha anisoptera Selys.		—			—				
Rhinocypha fenestrata (Burm.).			—	—	—				
Rhinocypha heterostigma (Ramb.).			—	—					
Rhinocypha selysi Krüger.		—	—						
Libellago lineata (Burm.).	—	—	—	—					
L.l. lineata (Burm.).	—	—	—	—					
Libellago sumatrana (Selys).		—	—						
Lestidae									
Platylestes heterostylus Lieft.				—					
Lestes concinnus Selys.			—	—	—		—	—	Madoera Is.
Lestes praemorsus Selys.	—	—	—			—	—		
L.p. praemorsus Selys.	—	—	—			—			
Megapodagrionidae									
Rhinagrion tricolor (Krüger).					—				
Platystictidae									
Drepanosticta gazella Lieft.			—	—					
Drepanosticta siebersi Fraser.					—				
Drepanosticta spatulifera Lieft.				—					
Drepanosticta sundana (Krüger).			—	—	—				

[1]) Under "Remarks" the nearest locality to Java is given if the species is not known from one of the regions listed, or if the distribution is discontinuous.

	Malaya	Sumatra	Java			Borneo	Celebes	Less. S. Is.	Remarks
			West	Mid	East				
Agrionidae									
Protoneurinae									
Caconeura autumnalis Fraser.			—	—	—				India
Caconeura delicatula Lieft.			—	—					
Caconeura humeralis (Selys).	—	?		—					
Notoneura insignis (Selys).		—	—	—	—				
Platycneminae									
Coeliccia lieftincki Laid.			—	—					
Coeliccia membranipes (Ramb.).	?	—	—	—	—	—			
C.m. membranipes (Ramb.).		—	—	—	—				
Copera annulata (Selys).	—	—	—						
Copera marginipes (Ramb.).	—	—	—	—	—			—	
Agrioninae									
Onychargia atrocyana Selys.	—	—	—	—		—			
Ceriagrion annulosum Lieft.		—	~	~	~				
Ceriagrion cerinorubellum (Brauer).	—	—	—			—	—		
Ceriagrion coromandelianum (F.)		—	—	—			—		
Ceriagrion erubescens Selys.	—	—		—					
Ceriagrion praetermissum Lieft.		—	—	—					
Pseudagrion bengalense Laid.	—	—	—	—					
Pseudagrion infracavum Schmidt.					—				
Pseudagrion microcephalum (Ramb.).	—	—	—	—	—	—	—	—	
Pseudagrion nigrofasciatum Lieft.					—				
Pseudagrion pruinosum (Burm.).	—	—	—	—	—	—			
P.p. pruinosum (Burm.)		—	—	—	—				
Pseudagrion rubriceps Selys.		—	—	—	—			—	
Archibasis melanocyana (Selys).	—	—		—		—			
Teinobasis euglena Lieft.		—		—					
Pericnemis stictica Selys.	—	—	—	—	—	?			
Argiocnemis rubescens Selys.	—	—	—	—		—	—		
Xiphiagrion cyanomelas Selys.			—		—		—	—	(Simaloer Is.)
Ischnura aurora Brauer.			—	—	—				India to Samoa
Ischnura senegalensis (RAMB.).	—	—	—	—	—	—	—	—	

	Malaya	Sumatra	Java: West	Java: Mid	Java: East	Borneo	Celebes	Less. S. Is.	Remarks
Agriocnemis femina (Brauer).	—	—	—	—	—	—	—	—	
Agriocnemis minima Selys.			—	—					
Agriocnemis pygmaea (Ramb.).	—	—	—	—	—		—	—	
Mortonagrion falcatum Lieft.									Karimoen Djawa
Aciagrion aciculare Lieft.		—	—	—					
Aciagrion fasciculare Lieft.			—						
Enallagma malayanum Selys.			~	—	~				India
Libellulidae									
Libellulinae									
Tetrathemis irregularis Brauer.	—	—	—	—		—	—	—	
T.i. hyalina Kirby.	—	—	—	—		—		—	
Tetrathemis platyptera Selys.	—	—	—						
Orchithemis pulcherrima Brauer.	—	—	—			—			
Lyriothemis cleis Brauer.	—	—	—	—	—	—	—		
Lyriothemis magnificata (Selys).	—	—		—	—	—		—	
Agrionoptera insignis (Ramb.).	—	—	—	—	—	—	—	—	
A.i. insignis (Ramb.).	—	—	—	—	—	—			
Lathrecista asiatica (F.)	—	—	—	—		—	—		
L.a. asiatica (F.)	—	—	—	—		—	—		
Potamarcha obscura (Ramb.).	—	—	—	—	—	—	—	—	
Cratilla lineata (Brauer).	—	—	—	—		—	—		
Cratilla metallica (Brauer).	—	—	~	~	~	—			
Orthetrum chrysis Selys.	—	—	—	—		—	?	—	
Orthetrum glaucum (Brauer).	—	—	—	—	—	—	—	—	
Orthetrum luzonicum (Brauer).	—	—	—	—					
Orthetrum pruinosum (Burm.).	—	—	—	—	—	—	—	—	
O.p. pruinosum (Burm.).		—	—	—	—				
Orthetrum sabina (Drury).	—	—	—	—	—	—	—	—	
Orthetrum silvarum Lieft.			—						
Orthetrum testaceum (Burm.).	—	—	—	—	—	—	?	—	
O.t. testaceum (Burm.)	—	—	—	—	—	—			
Orthetrum triangulare Selys.	—	—	—						
O.t. triangulare Selys.	—	—	—						
Brachydiplax chalybea Brauer.	—	—	—	—		—	—		
B.c. chalybea Brauer.	—	—	—	—		—	—		
Raphismia bispina (Hagen).	—	—	—			—	—		Karimoen Djawa

	Malaya	Sumatra	Java West	Java Mid	Java East	Borneo	Celebes	Less. S. Is.	Remarks
Acisoma panorpoides (Ramb.).	—	—	—	—	—	?	—	—	
Diplacodes nebulosa (F.).	—	—	—				—		
Diplacodes trivialis (Ramb.).	—	—	—	—	—	—	—	—	
Brachythemis contaminata (F.).	—	—	—	—	—	—	—		
Neurothemis fluctuans (F.).	—	—	—	—		—			
Neurothemis intermedia (Ramb.).				—	—		—		India, Assam &c.
N.i. excelsa Lieft.				—	—				
Neurothemis palliata (Ramb.).		—	—	—	—	—	—	—	
N.p. palliata (Ramb.).		—	—	—	—	—	—	—	
Neurothemis terminata Ris.	—	—	—	—	—	—	—	—	
N.t. terminata Ris.		—	—	—	—			—	
N.t. obscura Fraser									Karimoen Djawa, Sebesi
Neurothemis tullia (Drury).	—	—	—	—	—		—		
N.t. feralis (Burm.).		—	—	—	—		—		
Crocothemis servilia (Drury).	—	—	—	—	—	—	—	—	
Rhodothemis rufa (Ramb.)	—	—	—	—	—	—	—		
Trithemis aurora (Burm.).	—	—	—	—	—	—	—	—	
Trithemis festiva (Ramb.).	—	—	—	—	—	—	—	—	
Onychothemis abnormis Selys.		—	~	~	~				
Onychothemis culminicola Förster.	—	—	—		—	—	—		
O.c. culminicola Förster.	—	—	—		—	—			
Zygonyx ida Selys.	—	—	—	—	—	—		—	
Z.i. ida Selys.	—	—	—	—	—			—	
Zyxomma obtusum Selys.		—	—	—	—	—	—	—	
Zyxomma petiolatum (Ramb.)	—	—	—	—		—	—		
Tholymis tillarga (F.).	—	—	—	—	—	—	—	—	
Pantala flavescens (F.).	—	—	—	—	—	—	—	—	
Rhyothemis phyllis (Sulzer).	—	—	—	—	—	—	—	—	
R.p. phyllis (Sulzer).	—	—	—	—	—	—			
Rhyothemis triangularis Kirby.	—	—	~	~	~	—			
Hydrobasileus croceus (Brauer).	—	—	—	—		—	—		
Tramea limbata (Desj.).	—	—	—	—	—	—	—		
T.l. euryale Selys.	—	—	—	—	—				
Camacinia gigantea (Brauer).	—	—	—	—		—	—	—	Kangean
Macrodiplax cora (Brauer).	—	—	—	—	—		—		
Urothemis signata (Ramb.).	—	—	—	—		—			
U.s. bisignata Brauer.		?	—	—					
Aethriamanta aethra Ris.			—	—					

	Malaya	Sumatra	Java			Borneo	Celebes	Less. S. Is.	Remarks
			West	Mid	East				
Corduliinae									
Hemicordulia tenera Lieft.			—	—		—			
Procordulia sumbawana (Först).			—	—	—		—	—	
Procordulia artemis Lieft.		—	—	—					
Idionyx montana Krüger.	?	—	—	—	—	?			
I.m. montana Krüger.	?	—	—	—	—	?			
Macromia cincta Ramb.		—	~	~	~	—			
Macromia gerstaeckeri Krüger.			—						
Macromia moorei Selys.	—		—	—			—		
M.m. fumata Krüger.	—		—	—			—		
Macromia septima Martin.			—						
Macromia westwoodi Selys.	—		—	—	—	—			Banka
Epophthalmia vittata (Burm.).			—						India
E.v. sundana Lieft.			—						
Epophthalmia vittigera (Ramb.).	—	—	—	—	—	—		—	
Gomphidae									
Ictinus decoratus Selys.		—	—	—	—				
Gomphidia javanica Förster.			—		—				
Heliogomphus drescheri Lieft.		—	—	—	—				
Microgomphus chelifer Selys.	—	—	—	—		—			
M.c. thelyphonus Lieft.		—	—	—					
Leptogomphus lansbergei Selys.	?	—	—	—	—	—			
L.l. lansbergei Selys.			—	—	—				
Macrogomphus parallelogramma (Burm.)			—	—	—				
Megalogomphus icterops (Martin).			—			—			
Megalogomphus junghuhni Lieft.			~	~	~				
Burmagomphus inscriptus (Selys).				—	—				
Burmagomphus javicus Schmidt.			—	~	~				
Mesogomphus reinwardti (Selys).		—	—	—	—				
M.r. reinwardti (Selys).			—	—	—				
Onychogomphus banteng Lieft.			—						
Onychogomphus geometricus Selys.		—	—	—	—				
O.g. geometricus Selys.			—	—	—				
Onychogomphus modestus Selys.		—	—		—				India
O.m. fruhstorferi Lieft.		—	—		—				
Onychogomphus thienemanni Schmidt			~	~	~				

	Malaya	Sumatra	Java West	Java Mid	Java East	Borneo	Celebes	Less. S. Is.	Remarks
Cordulegasteridae									
Chlorogomphus magnificus Selys.		—	—	—					
Aeschnidae									
Amphiaeschna ampla (Ramb.)			—	—	—				Tonkin ??
Indaeschna grubaueri (Förster).	—	—	~	~	~	—			
Tetracanthagyna brunnea McLachlan.	—	?	—			—			
Heliaeschna uninervulata Martin.		—		—	—	—			
Gynacantha basiguttata Selys.	—	—	—	—		—	—		
Gynacantha bayadera Selys-Ris.	—	—	—	—	—	—	—		
Gynacantha dohrni Krüger.		—	—	—		—			
Gynacantha limbalis Karsch.	—		~	~	~	—			
Gynacantha musa Karsch.			—	—	—			—	
Gynacantha stenoptera Lieft.			~	~	~				
Gynacantha subinterrupta (Ramb.).	?	—	—	—	—	—	—	—	
Anaciaeschna jaspidea (Burm.).		—	—	—	—	—	—		
Anaciaeschna montivagans Lieft.			—	—					
Anax gibbosulus (Ramb.).		—	—				—	—	
Anax guttatus (Burm.).	—	—	—	—	—	—	—	—	

NOTES ON THE GENUS *DREPANOSTICTA* LAID.,

with descriptions of the larva and of new Malaysian species (Odon., Zygoptera).

By

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I. The ultimate larval instar of the genera *Protosticta* and *Drepanosticta*

In chapter XV of his 'Biology of Dragonflies' (Cambridge, 1917), TILLYARD united all genera with a regular quadrilateral and with reduced wing-veins Cu_1 and Cu_2 in his sub-family *Protoneurinae,* thus following DE SELYS who placed them in his group or "legion" *Protoneura.* The progress of researches on the order Odonata in the course of the preceding period enforced LAIDLAW, in the same year, to alter this system of classification and to remove *Drepanosticta* and other old-world genera (including the neotropical *Palaemnema*) from the legion *Protoneura* and to place them at the foot of the *Agrionidae,* between the legions *Platycnemis* and *Protoneura,* into the new "legion *Platysticta*" (Rec. Ind. Mus. 13, p. 339). Later, the same author went further and erected the new sub-family name *Platystictinae* for the reception of the same group of genera, pending the discovery of an interesting type of larva that would throw more light upon the relationships of this group (Spolia Zeylan. 12, 1924, p. 360).

In the meantime, ANNANDALE had been fortunate enough to discover the larva of *Protosticta gravelyi* LAIDLAW, an Indian species of the sub-family, which was described and figured by FRASER (Rec. Ind. Mus. 16, 1919, p. 465-466, pl. 35 fig. 4 and pl. 37 fig. 7). This larva, chiefly on account of the curious shape of its mouth-parts and tracheal gills, proved to be so entirely different from any other known type of Agrionid larvae, that LAIDLAW's opinion of the *Platysticta*-series of genera forming a group of their own, appears more than justified.

The larva of *Protosticta gravelyi* was described from two exuviae, picked up "from rocks in small rocky stream, Bhavani River, base of Nilgiris, 1500 ft., 24. viii. 1918, N. ANNANDALE." FRASER's description, though incomplete, allows a comparison with the larval skin of *Drepanosticta sundana,* described later. It runs as follows: —

"Mask very flat, ovate, resembling in some measure that of a Gomphine, the inner surface finely striated with rows of minute, transverse grooves; mid lobe with a well-marked cleft, the mouth of which is contracted so that the edges approximate and enclose a small fenestrum. The free biting edge of this lobe armed with a row of slightly irregular, fine teeth. Lateral lobes massive and short, ending in a blunt, molar-like tooth and furnished with a robust, moveable hook. No setae on the mask.

Head moderately large, eyes globular, synthorax small. Abdomen not spined laterally. Caudal appendages in a very poor, shrivelled condition. They appear to be lanceolate and triquetral in shape and without node or spines. Legs long and slim." (p. 466, *loc. cit.*)

The figures accompanying this description are not very distinctive but sufficiently clear to recognize a highly aberrant type of larva which is well worthy of further discussion.

Let us first consider a similar type of larva that, after prolonged search in various places, finally came into my hands and which gives a better idea of morphological features, allowing a more complete study of structural details.

This is the larva of *Drepanosticta,* a genus very closely allied to *Protosticta,* differing from this only in venational characters of but slight importance.

As hinted at further in the text, the Javan *D. sundana* (KRÜGER) is universally, though sparingly, distributed in the plains and lower mountain districts of Java, but occurs only in damp and shady surroundings where a forest-brook or torrential stream is found in close vicinity. More than once I had come across suitable breeding-places for this species, the adults being found on various occasions and in many localities. However, it was not until April, 1930, that I finally got a single cast skin of *sundana* in a torrential stream at the foot of Mt. Salak, near Buitenzorg. In the morning of April 6 I had, for a long distance, slowly been following the rocky bed of the Tjihideung river, in search of ovipositing females of *Trithemis festiva,* when I suddenly noticed the glittering wings of a long-bodied Agrionid arising from some point under the dark overhanging bank of the stream, and flying straight on to the sheltering trees. The specimen was captured and proved to be a freshly emerged ♀ of *D. sundana.* The spot whence it came being located, I got to work in order to find the nymphal skin and, at the end of ten minutes' close examination, quite fortunately found the soft and flabby cast-skin attached to the flat underside of a partly submersed rock of huge size, only half an inch above the surface of the water. The empty skin soon showed that it was of a type new to me, the most striking peculiarity being the presence of three strongly pointed caudal gills of the saccoid type. Being at last on the track of the breeding-place of *Drepanosticta,* I continued searching for the larva itself with a view to take them back alive to the laboratory for a study of the internal organs, but no single specimen was found, so I had to be content with this unique nymphal skin, of which the following description and figures were made.

Description of the nymphal skin of *D. sundana* (Krüger) Textfig. 1, pl. 9 fig. 1-6.

Head large, transverse, slightly concave posteriorly. Outline of compound eye indistinct, ocelli invisible. No definite colour-pattern. Labrum protruding, trapezoidal with rounded side-edges, three times wider than long, densely fringed with soft setae along distal margin.

Antennae long and slender, 7-jointed; joints 3-7 much thinner than the basal ones, third joint longest.

Mandibles unequal, stout, two-branched; external branch larger, its apex with four teeth which are subequal in length on the right mandible; on the left mandible there are only three teeth, the first counting from the dorsal margin is narrow and longer than the remaining two, which are broad and obtuse (second) or rectangular and plate-shaped (third). Internal branch of right mandible short and obtuse, on left mandible equal in length to the third tooth of external branch, its base with a strong internal spine; apex truncated with three distinct teeth on outer half.

Maxillae with the outer lobe slender and setigerous apically and with the inner lobe attenuate at tip, which bears three long ventral internal teeth followed on by a number of strong setae gradually decreasing in size, and three stout and strongly curved dorsal internal teeth (pl. 9 fig. 1).

Textfig. 1. *Drepanosticta sundana* (Krüg.). Nymphal skin, W. Java. Median caudal gill collapsed.

Labium when folded at rest reaching back to the bases of the prothoracic legs. Median (mental) lobe broad, plate-shaped, very slightly produced distad, with a deep and narrow median cleft bearing a number of radiant striae; distal margin entire, clothed with a great number of minute, flattened, scale-like setae which are widened and branched apically as shown in pl. 9 fig. 5. Mental setae absent; just around the median cleft are a few setae and on the middle of the mentum are two finely striated areas. Lateral lobes with a long moveable hook and with a simply rounded distal tooth (pl. 9 fig. 4).

Prothorax large and broad, smoothly rounded with two low dorsal tubercles. Meso-metathorax a little narrower. Front wing pads reach to the mid-length of abdominal segment 4, those of hind wing to the end of segm. 5. Legs long and slender, sparsely pilose; tibiae of anterior pair armed with a row of 3-4 strong setae along inner margin and with three short spine-like bristles at apex. Tarsi three-jointed, claws simple.

Abdomen cylindrical and rather semicircular in cross-section (shape not definitely preserved), of ten complete segments, long and slender (segm. 5 to 9 strongly telescoped in the single specimen examined). No colour-pattern discernible, yellowish. Segments unarmed, terminal ones a little hairy aside. Rudiments of ♀ gonapophyses large, shaped as shown in pl. 9 fig. 6.

The three caudal gills are of the saccoid type, and in outward appearance are very similar to the simple saccus of the Euphaeid genus *Diphlebia,* described in detail by TILLYARD. The gills lack a petiole and are much enlarged immediately after their base, increasing in width gradually to obtain their greatest width at halfway between the base and the end of the ovoid portion; thence they taper rapidly and are continued backwards to form longishly drawn out, pointed filaments. Median gill semi-transparent, evenly greyish purple-brown in colour, the convex dorsal surface is of darker brown chitin and finely pilose, the ventral and lower mesial surfaces distinctly paler and bearing very short and fine hairs only along lower margin at base. The posterior pointed portion of the gill is covered with irregularly placed hairs, most of which are long and slender, giving it a somewhat shaggy appearance. This gill receives two tracheae of the main abdominal trachea, which are well separated from each other and, although pursuing a very tortuous course, are not wound. These gill-tracheae give off a limited number of undulating side-branches which are again subdivided in their end portions; apically the two main stems enter the flagellum of the gill in which they can be followed for a long distance (pl. 9 fig. 3).

Each lateral caudal gill is longer than the median gill, very probably triquetro-cylindrical in cross-section, the mesial surface being approximately plane. Owing to the collapsed state of the gills, the opposed walls appear artificially closed together in this skin and therefore the exact outline of the caudal gills can not definitely be determined. There is much evidence, however, that they are in the form of a swollen sac or bladder, more or less sausage-shaped, although they may have a suspicion of the formation of longitudinal edges or midribs. In the figure of the larva the median gill is shown in the collapsed state (textfig. 1).

Only the following measurements can be given.

Length of labrum	0.5
Width of same	1.5
Antenna	2.96
Joints 1-7 of same	0.3, 0.5, 0.8, 0.6, 0.25, 0.26, 0.25
Length of labium	3.0
Width of same	2.4
Depth of median cleft	0.1
Length of median caudal gill	8.2
Length of lateral caudal gill	10.4 mm.

Hab.: — W. Java, slopes of Mt. Salak, Tjiomas (Waroengloa), 600 m alt., 6. IV. 1930, AUTHOR leg.

From the above description it will be clear that we have to deal with a type of larva which differs from the common form in various points.

1. The mandibles. — These are somewhat alike the type found in the Euphaeid genus *Euphaea* and the Polythorid *Cora*. They are asymmetrical and biramous, both having quite distinct so-called "molar" and "incisor" areas, the molar area of the right mandible being reduced to a blunt knob-like outgrowth, which is separated from the incisor group of teeth by a concavity; it is not clear whether the well developed molar area of the left mandible works into the hollow of the right one. — Biramous mandibles have so far been described only for *Euphaea, Cora* and *Hemiphlebia;* they are considered archaic but may occur in other Zygopterous Odonata.

   The shape of the maxillae does not afford any peculiarity.

2. The labial mask. — The shape of the labial mask is of considerable interest inasmuch as it is of a highly aberrant type: —
   a. The squarish form of the mentum is not found in any of the true *Agrionidae* (*Platycneminae* + *Protoneurinae* + *Agrioninae*). In general outline it bears some likeness to that of *Euphaea, Diphlebia, Cora* and, to a less extent, *Argiolestes.*
   b. The absence of setae on mentum and lateral lobes is also a character which will serve to distinguish our larval type from the *Agrionidae.* Here again we find much resemblance with the condition found in the *Euphaeidae, Polythoridae, Amphipterygidae* and *Megapodagrionidae.* In all known Agrionid larvae there is at least one mental seta.
   c. The cleft median lobe of the labium is apparently absent in all *Agrionidae,* except in the *Isosticta*-series of the *Protoneurinae,* but here the mask has a prominent median lobe, as in all Agrionid larvae, the cleft being possibly secondarily developed.
   d. The absence of any process on the side-lobe of the labium. This is a character not found, I think, in any other Zygopterous larva. In fact, the entire structure of the lateral lobe is strongly reminiscent of a Gomphine nymph.

3. The caudal gills. — The shape and internal structure of the caudal gills is unique among Odonate larvae. Having only a single exuviae at my disposal, I am unable to give a detailed account of the internal structure, and no sections could be made through the gills with a view to determine their natural shape. — The breaking-joint of the gill in *Drepanosticta* lies very near to its base, the gill being flexible but not easily detachable from the abdomen. In outward appearance the gills are entirely unlike those of the *Agrionidae,* being very obviously similar to the 'simple saccus' found in *Euphaea* and, more especially, *Diphlebia.* Like these, the larvae of *Drepanosticta* are rock-dwellers in fast mountain-streams, and like the Australian *Diphlebia,* are only found in the shallow rapids and never in the deep still pools. According to TILLYARD, *D.* clings

also to the under-surface of flat rocks lying in the main current, in company with Perlid larvae, which they sometimes resemble, except for their gills. They are however, unlike the Perlid larvae, very sluggish, and are only capable of rapid movements in the water. When a rock is lifted up with a *Diphlebia*-larva beneath it the dragging of the huge gills upon the wet rock-surface effectually prevents any speedy movement (Proc. Linn. Soc. N. S. Wales, 42, 1917, p. 75). In *Drepanosticta* (and *Protosticta* as well) we meet with a type of gills exactly corresponding to that of *Diphlebia lestoides;* they are pointed in the same way, and bear the same soft hairs. The distribution of tracheae appears also rather similar, only the main trunks are fewer in number and better developed, pursuing a course through the middle of the gill.

As might have been expected, a comparison of our nymphal skin of *Drepanosticta* with the described exuviae of *Protosticta* reveals no important generic distinction. The labia are very much alike and the caudal gills also do not appear different. A study of the rectal breathing apparatus, the larval wing-tracheation, and a closer examination of the tracheal gills, seems much to be desired.

The general conclusions which we may make from the above facts are that the larva of Platystictid dragonflies is a very primitive type, decidedly more archaic — at any rate much less specialized — than the most primitive members of the *Agrionidae,* viz. the *Isosticta-Selysioneura* series of the *Protoneurinae.* It shows no relationship with the larval forms of the *Synlestidae, Megapodagrionidae* and *Lestidae,* and the characters which it has in common with the families previously united in the *Calopterygidae* of DE SELYS, are certainly only due to convergence. The *Platysticta* series of genera is perhaps best placed between the *Hemiphlebiidae* and the *Agrionidae* (= *Coenagriidae* auct.), though relationship with the former is a very distant one.

The erection of the family ***Platystictidae*** appears to be absolutely necessary on the larval characters alone, and this family may be regarded as a specialized off-shoot of an early type of *Zygoptera* whose larva has preserved some strikingly primitive features.

II. The imagines of the *D. sundana* - group.

Drepanosticta kruegeri LAIDLAW (Pl. 10 fig. 1-4).

1926. LAIDLAW, J. Mal. Br. Roy. As. Soc. 4 (2), p. 228-229, fig. 2a-c (apps., pter., proth.) ♂♀ Siberoet, Sipora & Pagai Is. (*krugeri*).

Material examined: — One ♂ (ad., paratype), N. Pagai Is., X. 1924, C.B.K. and N.S., in coll. LAIDLAW.

Described in detail by LAIDLAW. A distinct species, characterized by the dull red-brown pterostigma which, according to LAIDLAW, in almost all specimens

examined is pentagonal instead of quadrangular, the distal side being broken by a veinlet dividing the cell distal to it into two. In the paratype ♂ from Sipora such a veinlet is present in two wings, but the ordinary four-sided shape of the pterostigma is not affected by it, so that I cannot regard the pentagonal shape as a specific character of *kruegeri*. A further means of distinction is found in the armature of the ♂ prothorax, the clubbed processes being exactly identical in shape and length with the same structure of *sundana*. The anal appendages are also similar in principle, although the superior pair is longer and of slenderer build, and not so strongly downbent as in *sundana*. The inf. apps., however, are entirely different (*cf.* fig. 1 on pl. 10).

The colouring of the body is generally paler than it is in the other two species, but no differences occur in the arrangement of the dark markings.

Length variable. ♂ abd. + app. 36, hw. 23 mm (LAIDLAW gives 39.7, 24 mm).

In the shape of appendages, this species comes very near to the Sumatran *arcuata*, from which it is at once distinguished by the pterostigma and the structure of the prothorax.

Drepanosticta arcuata sp. n. (Pl. 10 fig. 1, 2, 4).

? 1898. KRÜGER, Stett. ent. Zeitg. 59, p. 107-111. — ♀ Soekaranda, Sum. (*nec* ♂) (*Platysticta sundana*).

1927. RIS, Zoöl. Meded. 10, p. 19-20, 45, fig. 10 (apps. ♂). — ♂ S. W. Sumatra (*kruegeri*).

1934. SCHMIDT, Archiv f. Hydrobiol. Suppl.-Bd. 13, p. 334. — ♂ juv., S. Sumatra (*kruegeri*).

Material examined: — One ♂ (semiad.), S.W. Sumatra, Benkoelen, Soebanajam, VI. 1916, EDW. JACOBSON, in Mus. Leiden. Twe ♂♂, one ♀ (ad.), S. W. Sumatra, Lampong distr., Waiteboe near Talangpadang, 500 m alt., 24. VI. 1934; one ♀, same loc., Wailalaän, 250 m alt., 22. VI. 1934; all L. J. TOXOPEUS leg., in Mus. Buitenzorg.

The most obvious differences from *kruegeri* and *sundana* are given in the key to the species. RIS' s description was based upon two rather teneral individuals, one of which has been examined by the writer.

Male (ad.) — Generally a little darker and more slenderly built than *sundana*. Pale colour in front of head and of synthorax light blue. Abdominal segments still narrower, very thin. Ground-colour dirty ochreous, with markings similar to *sundana*, dark brown on the back, black behind.

Legs pale; femora distinctly ringed with black, knees jet-black.

Structure of prothorax entirely different from *sundana* and *kruegeri*. Posterior lobe with two flattened, diverging, ribbon-like lateral processes, which are directed almost straight upwards and then curled a little forewards. These processes are evenly narrowed towards the end, the apices being flat and very narrow, though not pointed, less hairy at extreme tips than in *kruegeri* and *sundana*.

Wings narrower and slightly more pointed than in *sundana;* neuration not appreciably different. Pterostigma deep black, surrounded by a fine yellowish line, smaller and higher than in *sundana*. In *arcuata* the proximal side is almost straight and the inner edge is rectangulate, whereas in *sundana* the proximal side is distinctly oblique, so that the inner edge appears acute-angulate (pl. 10 fig. 2).

The structure of the penis is quite similar to *kruegeri* and *sundana,* the slight difference noted being probably due to shrinkage or decomposition (pl. 10 fig. 3).

Superior anal apps. evenly curved towards apices, lacking the abrupt and prominent dorsal bend as seen in *sundana* (rather intermediate in shape between *kruegeri* and *sundana*). Inferior apps. similar in shape to *kruegeri:* distal portion extremely slender, strongly downbent with apices incurled and finely pointed (pl. 10 fig. 1).

Female (ad.) — Identical to the ♀ of *sundana,* except in the shape of wings and in its slightly darker colours. Structure of prothorax and genital organs not differing from that species; in both the side-portions of the posterior lobe are little prominent, rectangulate.

Size variable: ♂ abd. + app. 37-39, hw. 24-25 (RIS: 44, 27); ♀ 36-37, 25-26 mm.

Drepanosticta sundana (KRÜGER) (Pl. 10 fig. 1-2).

1898. KRÜGER, Stett. ent. Zeitg. 59, p. 107-111. — ♂ Java (*nec* ♀) (*Platysticta*).
1912. RIS, Tijdschr. Ent. 55, p. 160, pl. 7 fig. 2 (apps. ♂) — ♂ S. Java (*Platysticta*).
1929. LIEFTINCK, Tijdschr. Ent. 72, p. 113-114 (key), fig. 8 (apps. ♂) — ♂ S. Java.

Material examined: — A large series of both sexes from many different localities in West, Mid and East Java.

This is a well-known species, described by KRÜGER and by myself. RIS was the first to give sketches of the ♂ appendages, in which the very characteristic shape of the inferiors is well shown. Specimens from the western part of the island differ in no way from those captured on the slope of Mt. Raoeng, in the extreme eastern corner of Java, and this leads me to consider Sumatran *arcuata* specifically distinct from *sundana*. The outline figures of structural details of *sundana* were made from a ♂ captured by myself on Mt. Karang, the most westerly situated volcano on Java (N. Bantam residency). The points of difference between this and a specimen of *arcuata* from the Tanggamoes mountain in south Sumatra, are very striking.

Living males of *sundana* (and probably also fresh specimens of the allied species) have the upperside of the eyes dark olive-green in colour, the sides being bright apple-green. The prothorax is light blue above, and the base of abd.-segm. 8 is likewise blue. It the majority of females the labrum bears two bluish spots along base, the remainder being black; sometimes, however, only

the distal border is margined with black and occasionally the entire upper lip is coloured so.

As in the Javan *D. gazella* Lieft., there is considerable variation in the development of the side-edges of the ♀ prothorax. In most specimens these edges are produced into short triangular processes, but in many others the hind margin on both sides is simply rectangulate; lastly, in one female from Djampang Tengah (W. Java) the apical protuberances of the prothorax are long, distinctly clubbed and fringed with brownish hair at apex, being in fact quite similar to the clubs of the male. Curiously enough, in none of the numerous males which I have been able to examine such a variability in the structure of the hind lobe was noticed, all specimens having longish clubs.

No differences could be found in the shape of the penis in the three species under discussion.

The males are readily distinguished thus: —

1. Prothoracic hind lobe furnished with two parallel, straight club-shaped processes, which are directed straight backwards, lying down on the back of synthorax; clubbed apices fringed with longish hair.
   2. App. sup. gradually bent downwards and inwards, apical portion not so widened and apex rather more rounded; app. inf. broad at base, distal half without subapical dorsal tooth-like projection, very narrowly pointed apicad, with hook-like tips. Pterostigma red-brown .... ***kruegeri.***
   2′ App. sup. rather suddenly bent downwards and a little inwards, with apical portion more widened and apex truncated; app. inf. broad at base, but distal portion only slightly narrowed apicad, and with a distinct subapical dorsal tooth-like projection. Pterostigma blackish brown, or almost black .... ***sundana.***

1′ Prothoracic hind lobe furnished with two diverging, narrow and flattened, ribbon-like processes which are curled upwards and forewards; apices not clubbed, fringed with few, short hairs. App. sup. evenly and but little downbent, apical portion shaped much as in *sundana*. App. inf. very similar in shape to *kruegeri*, apical portion without tooth-like projection, very thin and slender. Pterostigma jet-black. ***arcuata***.

III. Descriptions of two new species of *Drepanosticta* from West Borneo.

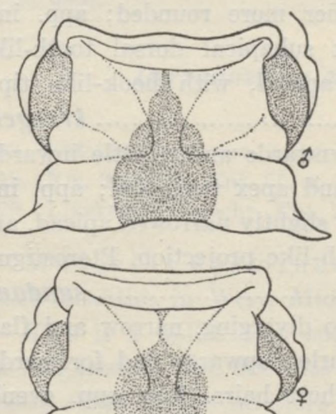
In "Konowia", 11, 1932 (1933), I published descriptions of three Bornean species of *Drepanosticta,* two of which were new. During the past three years I received from Mr. L. Coomans de Ruiter, of Singkawang, two other species of this genus, both extremely rare, captured in the same district and apparently quite distinct from any other known species. These are now characterized below.

Drepanosticta attala sp. n. (Textfig. 2-3).

Material examined: — One ♂, two ♀♀, W. Borneo, Singkawang-Bengkajang Rd., forest-brook near Seroekan, hill-country, 16. IV. 1934, 30. VIII. 1932 and 28. I. 1932, respectively. Type ♂ and allotype ♀ in Buitenzorg Museum.

Male (adult). — Labium pale yellow. Anterior surface of head coloured as in related species: labrum, anteclypeus and a small spot filling up the upper edge at base of mandibles, vividly cream-coloured with faint green intermingling. Labrum with sharply pronounced black stripe along anterior margin. Postclypeus shining black. Remainder of head dull bronzy black. Occiput black, very shining. Antennae missing.

Prothorax palest bluish white; a deep black spot, widest behind and almost pointed to in front, over the middle, ceasing at base of anterior lobe and covering the median third of posterior lobe. Sides also deep bronzy-black. The two broad light bands thus enclosed are very conspicuous and in dorsal view have the shape of an inverted V. Posterior lobe short and broad, not elevated, hind margin almost straight in dorsal view, side-portions produced laterad and ending in a short nipple-shaped process (textfig. 2).



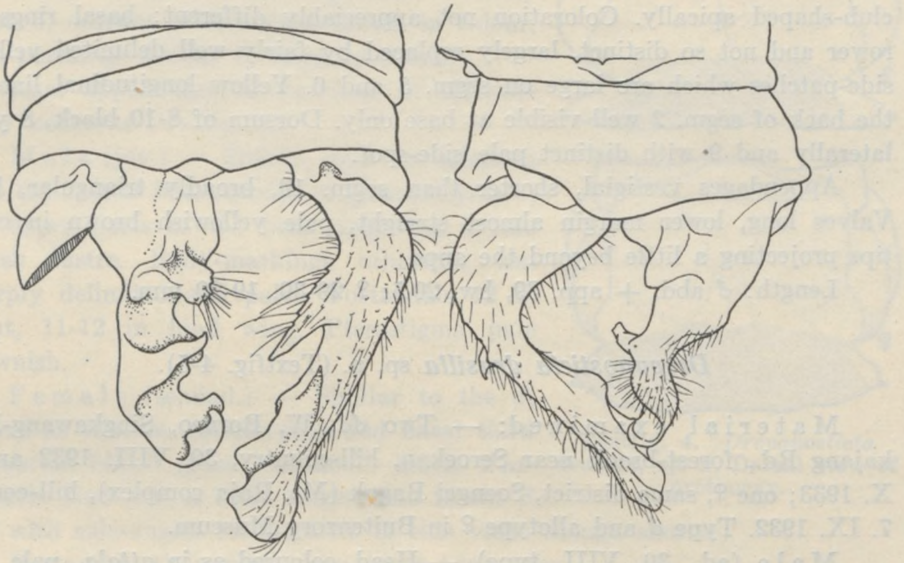
Textfig. 2. *Drepanosticta attala*, sp. n. Dorsal view of prothorax.

Synthorax, as far down as the first lateral suture, including the mesinfraepisternite, shining greenish bronzy-black with coppery reflections on mesepimerum. Sides palest bluish white with a strongly contrasting thick black stripe, slightly narrowed below, joining the second suture; this stripe is a little narrower than each of the white bands on both sides of it and does not include the spiracle, its lower (posterior) border being a little irregular. There is, besides, a very small blackish stripe placed upon the postero-dorsal edge of each metepimerite. Ante-alar triangles whitish. Venter pale.

Legs pale; coxae and femora yellowish white, exterior ridges of the latter with a sharp black stripe along full length of posterior two pairs, rather diffuse on anterior pair; knees blackish. Tibiae and tarsi pale ochreous, tibiae darkened interiorly and at base. Tarsi reddish; all spines dark brown.

Wings clear. Accessory basal postcostal nervure situated a trace beyond halfway base and Ax_1. Ac very oblique, placed midway between Ax_1 and Ax_2; it meets the wing margin in the production of the proximal side of q, joining Ab at margin under an obtuse and somewhat rounded angle in all wings. Cu_1 reaching the hind margin at 2-3 cells distal to the subnodus. Postnodals 12 in front, 11 in hind wing. M_3 arises slightly distal to subnodus in front, at the

subnodus in hind wing, *Rs* between nodus and Px_1. M_2 originates at the 6th postnodal in front, at the 5th or 6th in hind wing. M_{1a} 2 cells distal to M_2 in front wing, 2-3 in hind wing. Pterostigma jet-black, surrounded by a fine pale line, about 1½ times longer than high (almost twice longer than high in hind wing), a little widened distally; costal side distinctly shorter than anal side in front wing, less so in hind wing; proximal angle rather acute, distal side slightly convex.



Textfig. 3. *Drepanosticta attala*, sp. n. ♂ Anal appendages, dorsal view and right side (left sup. app. omitted).

Abdomen very long and slender, shaped as usual. Segm. 1-2 creamy yellow aside, light brown on the back; on segm. 2 the dorsal band is complete but narrowed to in front, and its anterior ⅔ part is divided into two halves by a clear yellow longitudinal stripe, which is widest towards the base of the segment. Segm. 3-7 dark brown with the exception of very narrow whitish basal rings. Dorsum of 8-10 blackish brown; on 8 there are traces of an ochreous side-spot along base, and on either side of the middle of 9 are placed two quite distinct, squarish blue basal spots. Segm. 10 black.

Anal appendages, sup. black, rather paler interiorly; inferiors ochreous brown (textfig. 3).

F e m a l e (ad.) — Very similar to the ♂, differs as follows. Labrum light blue, the black along distal margin more extensive, covering at least the distal half and projecting in the middle so as to form two oval pale spots at base. Anteclypeus wholly light blue. Mandibles entirely black.

Prothorax creamy white, the black spot almost circular; posterior lobe of the same characteristic form, the side lobes furnished with a long whitish

spine which is directed sidewards and a little forewards. Synthoracic colour-pattern as in the ♂, sharply contrasting. Upper surfaces brilliant metallic green. Ante-alar triangles bluish green.

Black stripes over exterior sides of femora effaced, barely visible; knees distinctly blackened.

Neuration similar to the ♂. *Ac* placed well beyond half the distance between Ax_1 and Ax_2. Postnodals 10-11 in front wing, 10 in hind wing. Pterostigma black.

Abdomen much shorter than in the opposite sex, evenly widened and rather club-shaped apically. Coloration not appreciably different; basal rings narrower and not so distinct, largely replaced by fairly well delimited yellowish side-patches which are large on segm. 5 and 6. Yellow longitudinal line over the back of segm. 2 well visible at base only. Dorsum of 8-10 black, 8 yellow laterally and 9 with distinct pale side-spot.

Appendages vestigial, shorter than segm. 10, broadly triangular, black. Valves long, lower margin almost straight, pale yellowish brown in colour, tips projecting a little beyond the apps.

Length: ♂ abd. + app. 39, hw. 20.5; ♀ 29-30, 19-20 mm.

Drepanosticta drusilla sp. n. (Textfig. 4-5).

Material examined: — Two ♂♂, W. Borneo, Singkawang-Bengkajang Rd., forest-brook near Seroekan, hill-country, 30. VIII. 1932 and 13. X. 1933; one ♀, same district, Soengei Bagak (Mt. Raja complex), hill-country, 7. IX. 1932. Type ♂ and allotype ♀ in Buitenzorg Museum.

Male (ad., 30. VIII, type). — Head coloured as in *attala*, pale areas vividly greenish yellow. Antennae light brown.

Prothorax, with the exception of the posterior lobe, pale bluish white; hind lobe black in colour, fading to yellow laterally; depressed, very broad, hind margin almost straight, the downbent side-portions obtuse angulate, projecting very slightly laterad and abruptly leaving off half-way down the prothorax (textfig. 4).

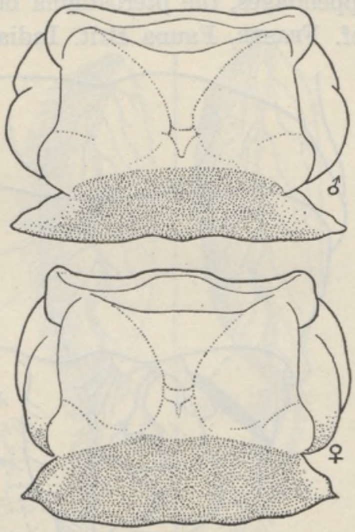
Synthoracic pattern almost exactly similar to the preceding species. Lower half of black stripe covering the second lateral suture a little narrower and middle portion more distinctly widened to behind. No blackish stripe on mesepimerites. Ante-alar triangles bluish. Venter pale.

Legs pale yellowish white. Exterior ridges of femora indistinctly blackish, but knees and bases of tibiae dark in colour. Tarsi reddish brown; all spines dark brown.

Wings clear. Anal cross-veins placed as in *attala*; two accessory basal postcostal nervures in right hind wing. Cu_1 reaching the hind margin 3½ - 4½ cells distal to subnodus. Postnodals 13-14 in front wing, 13 in hind wing. Position of the veins M_3 and *Rs* not different from *attala*. M_2 at the 7th or 8th postnodal in front, at the 6th or 7th in hind wing. M_{1a} 1-2 cells distal to M_2 in both pairs of wings. Pterostigma jet-black, not surrounded by

a pale line, fully twice longer than high in all wings and very slightly widened distally; costal side markedly shorter than anal side, distal side slightly convex.

Abdomen extraordinarily long and slender, much more drawn-out than in the preceding species. Segm. 1-2 and base of 3 pale green aside, light brown on the back; on segm. 2 the dorsal band is scarcely narrowed to in front, lacking a yellow median line. Segm. 3-7 as in *attala*, the whitish basal rings barely traceable. Segm. 8-10 distinctly clubbed, dorsum chiefly dark brown in colour, pale markings similar to those of *attala*.



Textfig. 4. *Drepanosticta drusilla*, sp. n. Dorsal view of prothorax.

Anal appendages brown, base of inferiors dirty ochreous (textfig. 5).

M a l e (juv.) — Differs from the adult in that the face is blue instead of greenish yellow, the upper parts of the head acquiring a fine bluish lustre. Body-markings otherwise less sharply delimited and paler. Postnodals 12 in front, 11-12 in hind wing. Pterostigma pale brownish.

F e m a l e (semiad.) — Similar to the ♂, differs as follows. Anteclypeus and basal third of labrum bluish green, remainder black. Prothoracic hind lobe a little longer than in the ♂ and with side-angles rectangulate in side view, though shorter.

Postnodals 13 in front wing, 12 in hind wing.

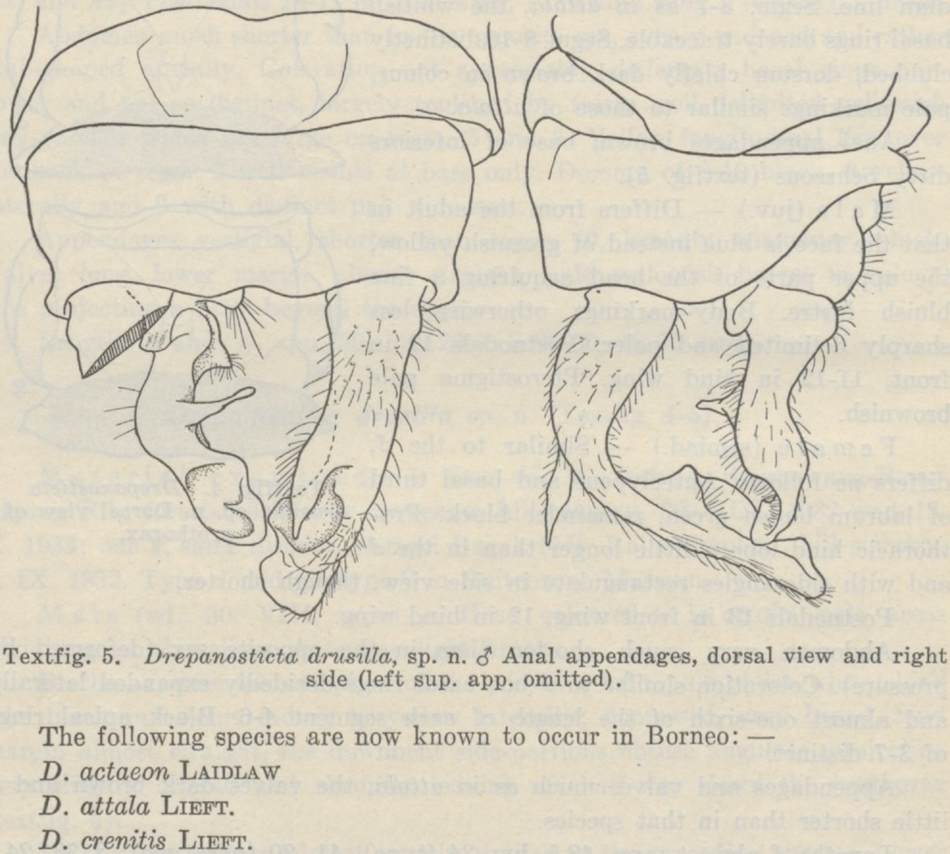
Abdomen very much shorter than in the opposite sex (deformed by pressure). Coloration similar to ♂ but basal rings decidedly expanded laterally and almost one-sixth of the length of each segment 4-6. Black apical rings of 3-7 distinct.

Appendages and valves much as in *attala*, the valves dark brown and a little shorter than in that species.

Length: ♂ abd. + app. 48.5, hw. 24 (type), 41, 20 (paratype); ♀ 38, 24.5 mm.

The two species, just described, should be placed within the *rufostigma*-group of the genus, which is represented in Borneo by *rufostigma* (SELYS) and *dupophila* LIEFT. The ♂♂ of our new species are very easily distinguished from the others by the strongly downbent superior appendages. The thick black stripe over the thoracic sides and the lightly coloured ante-alar triangles are two further characters which they have in common and by means of which they are immediately recognized from other species *D. drusilla* differs from *attala* chiefly by the great length of the ♂ abdomen, by the shape and colouring of the prothorax, and by the enormous spine on the sup. anal apps. The alternated black-and-white pattern of the prothorax of *attala* is a very striking feature of that species and produces strongly an impression as if it were scaled.

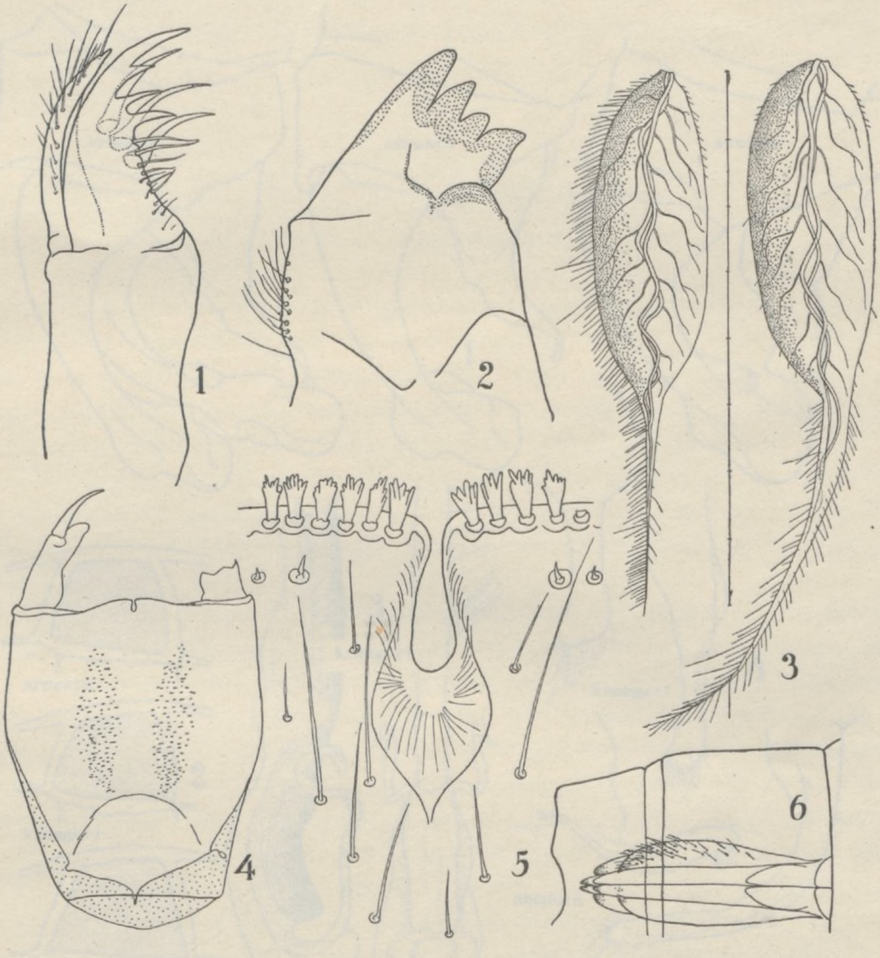
D. drusilla seems to find a near ally in *D. viridis* FRASER, from Mergui, Lower Burma. In both species the abdomen of the male is exceptionally long and attenuated, and both possess a strong spine at the point of angulation of the superior anal appendages. They differ mainly in the shape of the inferior appendages, the pterostigma being also much longer in *drusilla* than in *viridis* (cf. FRASER, Fauna Brit. India, Odonata I, 1933, p. 145-147, fig. 69).



Textfig. 5. *Drepanosticta drusilla*, sp. n. ♂ Anal appendages, dorsal view and right side (left sup. app. omitted).

The following species are now known to occur in Borneo: —

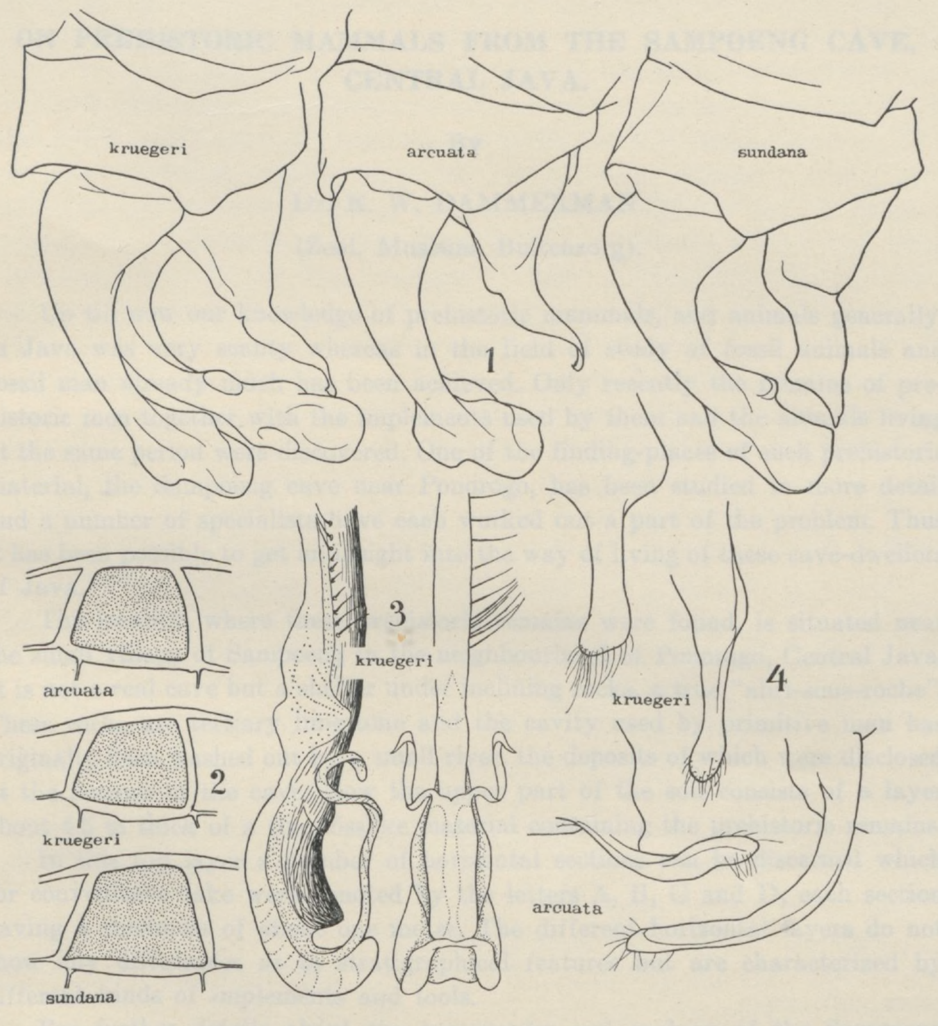
D. actaeon LAIDLAW
D. attala LIEFT.
D. crenitis LIEFT.
D. drusilla LIEFT.
D. dupophila LIEFT.
D. rufostigma (SELYS).



M. A. LIEFTINCK, Notes on Malaysian *Drepanosticta*.

Larval structures of *D. sundana* (KRÜGER).

Fig. 1. Right maxilla, ventral aspect.
Fig. 2. Right mandible, ventral aspect.
Fig. 3. Median and left lateral caudal gills, interior view.
Fig. 4. Interior view of labium.
Fig. 5. Medio-apical portion of mentum, showing median cleft, marginal scales and setae.
Fig. 6. Ventral view of female gonapophyses.



M. A. LIEFTINCK, Notes on Malaysian *Drepanosticta*.

Fig. 1. Right side-view of male anal appendages.
Fig. 2. Pterostigmata of right front wing.
Fig. 3. Penis, left side and ventral view.
Fig. 4. Right half of male posterior lobe of prothorax, dorsal (left) and right side-view (right).

ON PREHISTORIC MAMMALS FROM THE SAMPOENG CAVE, CENTRAL JAVA.

By

Dr. K. W. DAMMERMAN

(Zool. Museum, Buitenzorg).

Up till now our knowledge of prehistoric mammals, and animals generally, in Java was very scanty whereas in the field of study of fossil animals and fossil man already much has been achieved. Only recently the remains of prehistoric men together with the implements used by them and the animals living at the same period were discovered. One of the finding-places of such prehistoric material, the Sampoeng cave near Ponorogo, has been studied in more detail and a number of specialists have each worked out a part of the problem. Thus it has been possible to get an insight into the way of living of these cave-dwellers of Java.

The locality, where these prehistoric remains were found, is situated near the small village of Sampoeng in the neighbourhood of Ponorogo, Central Java. It is not a real cave but a shelter under inclining rocks, a true "abri-sous-roche". These rocks are tertiary limestone and the cavity used by primitive man has originally been washed out by a small river, the deposits of which were disclosed at the bottom of the cave. Now the upper part of the soil consists of a layer about 4.5 m thick of a fine lösslike material containing the prehistoric remains.

In this top layer a number of horizontal sections can be discerned which for convenience sake were denoted by the letters A, B, C and D, each section having a thickness of about one metre. The different horizontal layers do not show any differences as to stratigraphical features but are characterized by different kinds of implements and tools.

For further details about the topography and geology of the Sampoeng cave the reader is referred to the paper by VAN ES [1]), the geologist who made the first excavations and brought to light many remarkable finds. Later on in 1927 more systematic investigations were instituted in collaboration with VAN STEIN CALLENFELS of the Archaeological Survey [2]).

The exact place where each prehistoric implement or utensil was found, also of the human remains, has been ascertained with regard to depth as well

[1]) VAN ES, The prehistoric remains in Sampoeng cave; Proc. 4th Pac. Science Congress, Vol. III 1930.

[2]) V. STEIN CALLENFELS a.o., Hommage Service Archéol. Ind. Néerl. 1er Congrès Préhistoriens á Hanoi, 1932.

as to the horizontal position. Unfortunately the animal remains were all thrown together, only those belonging to different sections A - D having been kept separate. Therefore if an animal species is recorded from two sections only this has no definite significance as to the extension of the dispersal in the different layers, as some of the specimens may have been derived from the lowest part of a section and others from the top of the next one.

According to the type of implements the sections A - C revealed some very peculiar discrepancies (see VAN STEIN CALLENFELS). The top layer of the cave beds contained besides stone mortars and other utensils, stone axes carefully polished, a type of implement supposed to belong to the late neolithic. But in the next layer B practically no stone implements or pot-sherds are represented, nearly all the tools being spatules or scrapers made from bone or horn. The latter most likely served for cleaning skins which provided the articles of dress. At first sight it seemed that here a period of the stone-age succeeded a period of culture during which mainly bone implements were used, but the underlying layer C is again characterized by stone manufacts especially winged arrow-heads with a concave base and serrated edges. From the same layer also mortars and pot-sherds appeared again. It is not to be doubted that this layer C is much older as the bones derived from it show a much more intimate cohesion with the surrounding soil.

Now it is certainly a most noteworthy fact that the majority of the animal species and the great bulk of the remains of those mammals which apparently were hunted for food are found just in layer B, the layer in which nearly all hunting weapons are absent.

That hunting was the chief means of livelihood may be deduced from the great quantities of game animals detected in layer B. But the food did not consist exclusively of venison: fish and fruits were also eaten. Fish-bones and many hard fruit skins have been dug out which, however, do not allow a further identification. Besides these foods many snails were taken, these being found in large numbers among the other remains of food [1]).

Cooking must have been a well-known practice for a number of fire-places have been uncovered, mostly being undisturbed with woodash and scorched bones still intact.

The age of the cave deposits is estimated to be from about 1000 year before Christ. But at the time these primitive cave-men, who according to MIJSBERG show Australoid characters, were living more inland other people of a more advanced civilization may have been inhabiting the coastal regions. There must have been some intercourse between these aboriginal tribes as the inland inhabitants used preferably marine shells for ornament.

Taking into account the primitive and rather small weapons which the cave-dwellers had it is surprising that the main hunting object was such big

[1]) VAN BENTHEM JUTTING, On prehistoric shells from Sampoeng cave; Treubia Vol. XIV 1932.

game as the banting. A rather amazing quantity of teeth and leg bones of this species was brought to light. Almost only these parts were discovered, other bones of the trunk, vertebrae or ribs being almost entirely absent. Therefore it may be inferred that the whole animal was not taken home, but only the head and the limbs. The same holds good with regard to the other game animals as of these species also mainly the parts referred to above were excavated.

Considering the large number of teeth found the almost total absence of skull bones and horns of the banting is very curious. Evidently the skulls were entirely smashed for procuring the brains. In the same way all the larger bones of the limbs were split or broken to get the marrow. However, the great quantity of fragments of bones taken from layer B may also be an indication of these bigger bones also having been broken into suitable pieces from which the bone implements were to be made. But the absence of horns or horn fragments of the banting is not easy to understand, the enormous number of beasts killed being out of proportion to the number of utensils made from horn.

In all layers the banting is the most prominent game animal, next to it comes the wild swine followed by deer and muntjac. With the exception of layer C (that of the arrow-heads) in which deer become more abundant, this proportion is the same in the various layers. Whether this is due to the fact that the cave-men altered their mode of hunting, or that this species of game became more abundant at that period must be left undecided.

We should like to call attention to the fact of the wild swine belonging to the species *Sus vittatus,* the widely spread common Java swine nearly related to the domesticated form, whereas remarkably enough the warted swine, *Sus verrucosus,* is not represented although this species is considered generally as a much older form.

Besides the animals noticed before which constituted the main food a great many other species have been discovered. A number of species have been already recorded by VAN ES among which he mentions the horse. We did not come across the remains of this animal and most likely the heavy teeth of the buffalo were mistaken for those of a horse. The finding of the latter in prehistoric time in Java would certainly be a most remarkable discovery. Many of the species of which only a few bones or a single tooth has been dug out may accidentally have got into the shelter, others like rats were obviously inhabiting it on account of the rich garbage. But still others were apparently killed for the purpose of obtaining the large canines which were used as ornaments. Foremost among these ranks the palm civet (*Paradoxurus hermaphroditus*) of which a great number of jaw bones have been found and two teeth with holes drilled into them. Yet teeth do not seem to have been used largely for adornment, shells or pieces of mother of pearl being preferred to a far larger extent.

Now among the remaining species there are few worthy of some closer consideration. For example, the Javanese one-horned rhinoceros the present distribution of which does not extend so far to the east. Then there are three other noteworthy species two of which have become extinct in Java, the third

one being the common buffalo. The last-named species is represented by very few remains which, however, exceed in size those of the recent form. In this respect the prehistoric form agrees very well with the fossil buffalo known from the pleistocene deposits of Java. As palaeontologists consider this fossil form specifically identical with the recent one the question arises as to whether the domesticated form in Java is a descendant from this prehistoric and fossil stock, or whether the latter has died out and the tame form has been introduced later on. We will revert to this subject more fully in a separate paper.

Another animal now certainly extinct in Java is a species of deer. Of this species nothing but a single fragment of the antler has been disclosed but this piece is so characteristic that it cannot be classified as belonging to either the common Java deer, or the muntjac (see Pl. 11 fig. 2). Owing to the very peculiar form of the antler it has to be considered as belonging to the species *Cervus eldi,* which does not occur at the present time in the Indian Archipelago but has been found in a fossil state in Java. The suggestion that this fragment is derived from older strata and only in the cave beds by accident is not very probable as this piece of antler is scorched by fire and the layers in the cave remained practically undisturbed.

Finally we have to notice the finding of remains of an elephant, another species extinct now in Java. The parts found are very scanty but the molar ridges which came to light match exactly those of the Indian and Sumatra species. As the Indian elephant (*Elephas maximus*) has been found in pleistocene deposits in Java [1]) there is every possibility of the prehistoric form being this species. In any case we are dealing here with the same genus.

Here again, as in the case of the buffalo the question has to be considered whether elephants were still living in Java in historic time. Now in many instances elephants are recorded from Java. Old Chinese chroniclers tell that the kings of Java rode on elephants [2]) but they are speaking of a period after the Hindus had arrived in Java, so these elephants may have been introduced. That importation of such large animals actually took place notwithstanding the small and primitive vessels used in those early days is recorded in the same chronicles. Living elephants and even rhinoceroses were sometimes presented to the emperors of China as tributary gifts.

Another fact worth mentioning recorded by these Chinese chroniclers is the exportation of ivory from Java in ancient times. They also tell that the king of Java sent an embassy to the Chinese emperor and among the presents was also ivory which was called "kara" in the language of Java. Kara, however, is a sanskrit word meaning elephant's trunk. We certainly have to accept these statements with every caution as formerly localities were not always carefully discriminated and, moreover, products arriving from a certain country were

[1]) V. D. MAAREL, Contribution to the knowledge of the fosil mammalian fauna of Java; Wet. Med. Dienst Mijnb. Ned. Ind., No 15, 1932.

[2]) Cfr. GROENEVELDT, Notes on the Mal. Arch. and Malacca compiled from Chinese sources; Verh. Bat. Gen. Vol. 39, 1880.

often denoted as originating from that region. But anyhow in connection with our prehistoric find we should not reject altogether these old stories.

I should also like to draw attention to the old Javanese language having its own word for elephant, i.e. "liman", related to "lima" = five or hand. "Liman" thus means "the beast provided with a hand": the Sanskrit word for elephant "hastin" has the same meaning. The comparison of the trunk of an elephant with a hand is certainly very old. ARISTOTELES speaking about this pachyderm said: it possesses a nose which is used like a hand.

We hope that future researches will throw further light upon this interesting question.

List of the species found in the different layers

layer depth	A 0 — 1 m	B 1 — 2 m	C 2 — 3 m	D 3 — 4 m
Primates				
Macaca irus		×		
Pithecus pyrrhus		×		
Nycticebus coucang		×		
Ungulata.				
Elephas maximus (?)		×		
Rhinoceros sondaicus		×	×	
Bos banteng	×	×	×	×
Bos bubalis		×	×	
Cervus hippelaphus	×	×	×	×
Cervus eldi			×	
Muntiacus muntjak	×	×	×	×
Tragulus kanchil		×		
Sus vittatus	×	×	×	×
Carnivora				
Felis tigris			×	
Felis bengalensis		×		
Paradoxurus hermaphroditus		×	×	
Cuon javanicus		×		
Lutra cinerea		×		
Rodentia				
Hystrix javanica		×	×	×
Petaurista petaurista		×	×	
Ratufa bicolor		×		
Sciurus notatus		×		
Rattus sabanus (?)		×		
Rattus rattus		×		
Rattus spec.		×	×	

TAXONOMIC PART

PRIMATES

Macaca irus CUV. (*Cynomolgus fascicularis*) [1])

Only one fragmentary left mandible and some teeth (from layer B). The mandible with 3 molars (m_1, pm_{1-2}); 1 left lower molar (m_3) and 1 right lower canine.

Pithecus pyrrhus HORSF. (*Semnopithecus maurus*)

One piece of right maxilla with a complete molar series (length 30 mm) and the canine; idem with 4 molars (m^{1-2}, pm. $^{1-2}$); idem with 4 molars (m^{1-3}, m^1 and pm^2 broken); one piece of left maxilla with 4 molars (m^{1-3}, pm^2); idem with 5 molars. One piece of left mandible with 4 molars (m_{1-3}, pm_2); idem with 3 molars (m_{1-2}, pm_2) and the canine. All from layer B.

Nycticebus coucang BODD. (*N. tardigradus*)

Only one piece of a right mandible with 4 molars (m_{1-2}, pm_{1-2}) and the canine, from layer B.

UNGULATA

Elephas maximus L. (?)

Of this species only two molar ridges of a semi-adult animal partly broken were found in layer B (see Pl. 11, fig. 1), which exactly match ridges of the recent Sumatran elephant.

Rhinoceros sondaicus DESM.

A number of molars, partly fragmentary from layer B and C, and four poorly preserved mandibular incisors. At least three specimens are represented for there are besides the incisors two left upper m^3 and one deciduous upper and three deciduous lower teeth from a young individual. The molars are of normal size but the incisors are rather heavy. Of other bones the nail phalanx of a fore middle toe was excavated.

Bos banteng RAFFL. (*Bibos sondaicus*)

This species is the most common of all the animals found in the cave deposits. It is represented by an enormous quantity of teeth. There are remains of at least 83 specimens from layer B as this number of right lower third molars was counted against 79 of the left mandible. As many teeth are broken and difficult to classify the number of individuals is positively far beyond the above estimation. In other layers this number is far less, in layer A 4, in layer C 15, and in layer D only 1 specimen being represented.

Some molars are blackish, a few apparently scorched by fire but others are pigmentated by some soil component. The length of the third lower molar is varying from 37.7 to 43 mm.

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[1]) The synonyms given are the names used in TROUESSART's Catalogue Suppl. 1904.

Measurements of m_3 of banting

37.7—37.9	38—38.9	39—39.9	40—40.9	41—41.9	42—42.9	43 mm.
1	1	5	1	2	1	1

Other bones are rarely met with excepting those of the fore and hind limbs, which are rather numerous. The larger leg bones are all broken and split lenghtwise apparently to get at the marrow, the capita only having been left intact. Further, only a few cervical vertebrae and ribs, a portion of a scapula and some pieces of horn cores were dug out. Complete horns were altogether absent only small fragments being found for the greater part polished and shaped into slabs.

Not a single skull was brought to light and even skull-bones were rare, only fragments of the maxillar bones or mandible being present.

Bos bubalis L. (*Buffelus bubalus*)

The remains of a species of buffalo are very scanty but some very large molars and leg bones are almost certainly to be attributed to *Bos bubalis*. A third lower molar from layer C measures 48.1 mm in length and 21 mm in breadth, an upper m^3 is 74.8 mm heigh and 38 mm long. Another lower molar (m_1 or m_2) from layer B is 67.4 mm in heighth (without root) and the length 35.1 mm. For the rest only fragments of these large molars are extant.

Other bones could not be ascribed to this species with any certainty with the exception of a few smaller bones of the foot, especially four astragali which by their big size could not belong to the banting: of these one is from a left foot, the other three from right feet.

The measurements of these bones are:

greatest length: 100.5, 93.5, 93.8, 97.5 mm

„ breadth: 77.6, 67.3, 70.8, 74.4 mm

Further a second phalanx was detected with a length of 70.6 mm and breadth of 59.5 mm, and a calcaneum long 167.5, broad 69.6 mm.

These molars and foot bones are not only far bigger than those of the banting but also exceed those of the recent buffalo. Now the fossil buffalo known from diluvial deposits of Java is also a far larger animal than the domesticated form and in this respect our prehistoric buffalo agrees fairly well with the fossil one. Whether the fossil and prehistoric forms are specifically identical with the recent one is a question to which I will revert again in another paper.

Cervus hippelaphus Cuv.

This species is represented in all four layers but is most numerous in layer C, a condition somewhat the reverse of that of other species which are all more common in layer B. In layer A only one single molar was found, from layer B remains of at least 3, and from layer D of 2 specimens came to light, whereas layer C yielded teeth and bone fragments from 18 individuals, among which

are an almost complete skull from a semi-adult roe, and several parts of antlers. The antlers are never complete: all seem to have been broken into pieces which for the greater part show traces of manufacturing or are blackened by fire. Some of these are ground or sharpened so as to be shaped into an implement for piercing or digging, others are split and hollowed.

Bones of the legs, which do not occur commonly, are not split but broken.

Cervus eldi GÜTHRIE

A peculiar piece of antler also from layer C was found among the remains of the common deer. Although this fragment was very incomplete it obviously could not belong to either the Java deer or the muntjac. Owing to the brow tine forming a continuous curve with the beam, and both standing almost horizontally upon the pedicel this antler most probably has to be identified as that of *Cervus eldi*, as no other deer has similar antlers (see Pl. 11, fig. 2). This species, the brow-antlered deer inhabiting the mainland of South-east Asia, does not occur now in Java but has been found there in a fossil state, living in the pleistocene period. The absence of an axillar snag is probably due to the specimen being not full-grown. The fragment has also been compared with another fossil species known from Java, *Cervus axis*, but in this the brow tine joins the beam at a distinct angle (Pl. 11, fig. 2 c).

Muntiacus muntjac ZIMM. (*Cervulus muntjac*)

This is another species of deer which seems to have been hunted by the cave-men in fairly large quantities. The muntjac is represented in layer B by almost the same number as the common deer in layer C. In the other layers the species is scarcely met with.

To a still larger extent than the antlers of the deer those of the muntjac were used for making tools, perhaps owing to their more convenient size. The tines and beams are often broken or split, nearly all ground or polished, the rough surface being smoothened, and made into utensils used as drills or spatules.

With the exception of teeth and antler fragments, bones are scarce: only a few broken leg bones and e few vertebrae were discovered.

Tragulus kanchil RAFFL.

Only one portion of a left mandible with 4 molars (m_{1}-$_{3}$, pm_3) from layer B but no other remains of this species were excavated.

Sus vittatus TEMM.

After the remains of the banting those of this species of wild swine are most abundant. From layer B the remains of at least 29 specimens were counted, against only 3 from layer A, 6 from C, and 1 from D.

Molars, incisors and tusks predominate among the parts that are preserved, but leg bones, especially their more solid extremities were also found, the shafts being broken into numerous fragments. Furthermore there are two pieces of a scapula and a cervical vertebra.

CARNIVORA

Felis tigris L.

Of this largest beast of prey nothing was found except a single upper sectorial tooth and a right upper incisor (i^3) from layer C. The molar, a part of which is broken off, is of normal size, the incisor being rather stout but not surpassing the same tooth in a full-grown recent tiger.

Felis bengalensis KERR.

This wild cat is only represented by a fragment of a right maxillar bone containing 2 molars (pm^{2-3}).

Paradoxurus hermaphroditus PALL.

This civet ranks first among the carnivorous animals. From layer B especially, a large number of mandibles came to light, whereas layer C yielded only one piece of the same bone. As moreover two canines were found with holes drilled in them it seems likely that the primitive cave-dwellers preferably used the teeth of this species for ornamental purposes.

Remarkably enough no remains of other bones have appeared. Whether this is due to the fact that only the jaw-bones were taken into the dwelling-place or to some other reason must be left undicided for the moment.

Cuon javanicus DESM.

A single molar of the right maxillar (m^1) undoubtedly belongs to this species.

Lutra cinerea ILLIG.

A fragment of a right mandible with two molars (pm_2-$_3$) is all that came to hand of this species.

RODENTIA

Hystrix javanica CUV.

The porcupine is represented in all layers except layer A but like most of the other animals it is more numerous in layer B. Of this species also little but fragments of mandibles and of incisors were excavated.

One piece of a left mandible with two molars (pm_1, m_3) and the incisor, broken off; three parts of right mandibles with respectively 2 molars (pm_1, m_1) and 4 molars with the incisor, broken off, and one fragment with a broken incisor. From layer C another fragment of a left mandible with two molars (m_1-$_2$) and three pieces of the lower part of the humerus.

Petaurista petaurista PALL. (*Pteromys nitidus*)

This large flying squirrel is found both in layer B and C. From layer B are one left and one right mandible both with 4 molars and the incisor, the latter broken off; another left mandible without molars but with the molar alveoli complete. In layer C only a piece of a left mandible with a complete molar series.

Ratufa bicolor SPARRM.

The material at hand of this species of giant squirrel is also very scanty. Only one right fragmentary mandible with 4 molars but the incisor broken off, and one entire upper incisor.

Sciurus notatus BODD.

A single right mandible with the molar series complete and of normal length (9 mm).

Rattus sabanus THOS. (?) (*Mus sabanus*)

A left mandible is with some hesitation identified as belonging to this species of rat, although the molar series is rather large (9.8 mm).

Rattus rattus L. (?) (*Mus rattus*)

Of two other species of rats there are a large number of mandibles collected by VAN ES in 1926. One set of 13 mandibles has a molar series with an average length of 6.7 mm (max. 7 mm), in this as well as in other respects agreeing very well with the common *rattus*.

But in another much larger series of 42 mandibles the molar row varies from 7.3 - 8.1 mm in length, average 7.7 mm. For the moment we are unable to allocate these to one of the recent species of rats found in Java.

Fig. 1. Molar ridges of *Elephas maximus* (?); $^{3}/_{5}$ nat. size.

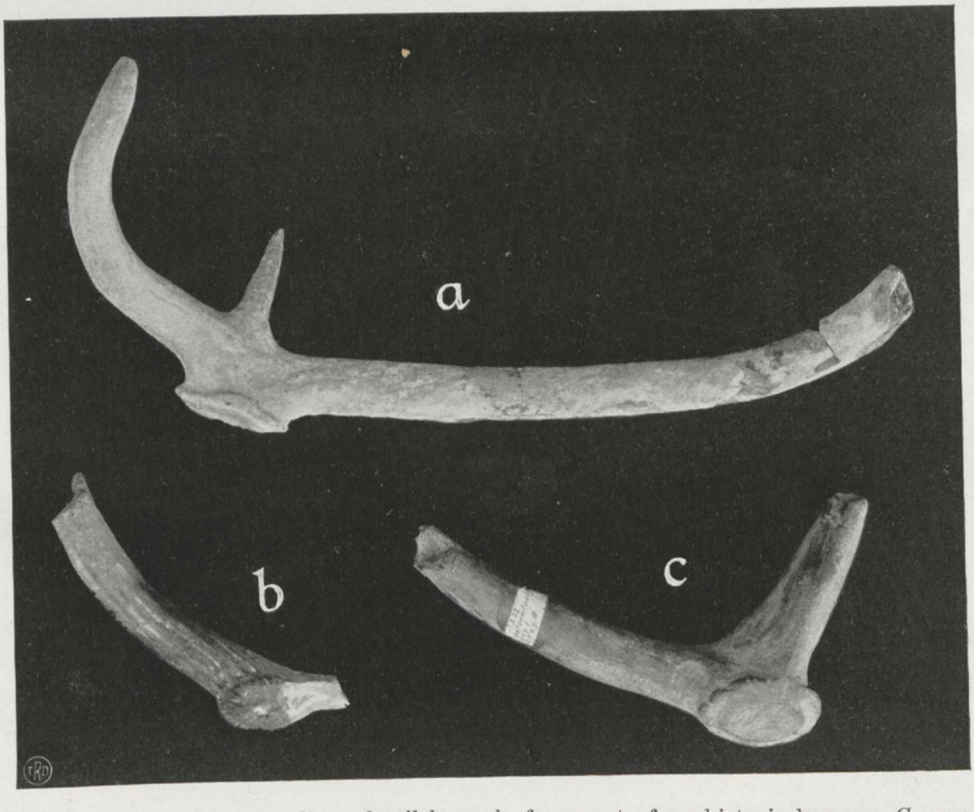

Fig. 2. a. & b. *Cervus eldi*; a. fossil horn, b. fragment of prehistoric horn; c. *Cervus axis*, fragment of fossil horn; $^{2}/_{5}$ nat. size.

ON THE OCCURRENCE OF WILD BUFFALOES IN JAVA AND SUMATRA.

By

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(Zool. Museum, Buitenzorg).

With reference to my previous paper on the prehistoric mammals from the Sampoeng cave I should like to discuss here in more detail the question whether there still are living truly wild buffaloes in Java and the Indian Archipelago generally.

The first point for consideration is: is the fossil and prehistoric buffalo found in Java identical with the recent tame form? As to the fossil form discovered in pleistocene beds DUBOIS described it as a specific form, *Bubalus palaeokerabau,* differing from the recent species in the shape of the horn cores, the cross section of which is triangular to nearly half-circular, the frontal edges above and beneath being angular. This shape of the horn core, however, is also encountered in the recent form and does not warrant specific distinction. Later on STREMME gave a more detailed description of a cranium, arriving at the conclusion of the fossil form belonging without doubt to *B. palaeokerabau,* but at the same time emphasizing the very close relationship to the recent species.

Therefore it is no matter of surprise that at present palaeontologists unit the fossil and recent species. V.D. MAAREL considers the fossil buffalo of Java indistinguishable from the recent one, although the fossil form is diverging by the greater constriction of the occiput. However, in his opinion this difference is not even sufficient to allow racial distinctness. Consequently the fossil form has, according to him, no right to specific distinctness and is called *Buffelus bubalus* var. *sondaicus fossilis.*

This author had only some skulls and two separate horn cores at his disposal. Concerning the name given by him it is very doubtful whether this name can be applied to the fossil form. The name *sondaicus* was introduced by SCHLEGEL and MÜLLER for the tame race of the Archipelago, on account of its showing some deviations from the wild buffalo of India and the domesticated form of Asia and South-Europe. Although they give a full description they do not tell what these differences are and the name *sondaicus* is therefore not quite valid. Moreover, application of this name of a domesticated race to the fossil species supposes first that the former is racially distinct from other domesticated or wild forms and in the second place that the fossil form is the true ancestor of our present buffalo in Java. For both suppositions no arguments are given and both question are still open for discussion.

Now as already mentioned in my previous paper the prehistoric buffalo discovered in the Sampoeng cave is much larger than the recent domesticated form in Java and the few bones found match exactly those of the fossil species (see Pl. 12). Up to the present a good description of this fossil buffalo has not been published, but in the Geological Museum at Bandoeng a great amount of material is extant and an almost complete skeleton has been mounted. The figures given below I owe to Dr. VON KOENIGSWALD, palaentologist of the said Museum.

Measurements of fossil and recent buffaloes (in mm)

	fossil	recent
height at shoulder	1600 [1])	1300 - 1450
total length of skull	± 550	468 - 533
zygomatic breadth	280	196 - 219
total length of mandible	524	427 – 460
length upper molar series	166	128 – 145
length lower molar series	164	138 – 159
length of lower m_3	43 – 45	35.1 – 39.6
length of humerus	383	327
length of radius & ulna	500	404
length of femur	534	388
length of tibia	514	366
length of calcaneum	185	152 5
length of astragalus	101.6 – 106.5	74.6
basal girth of horn core	340	202 – 304
greatest length of horn core	1300 [2])	283 – 451

[1]) height of skeleton. [2]) tip broken off.

From these figures the great difference in size between the fossil and tame buffalo of Java is claerly demonstrated. According to MERKENS the average height of the Malay buffalo is about 1.30 m, castrated bulls may reach a height of 1.45 m, whereas the wild Indian buffalo is said to measure in height up to 1.80 - 1.90 m. Yet size alone does not prove specific gradation and as moreover many prehistoric animals are much larger than their recent congeners the difference may be of racial rank only. We should call also attention to the fact that the living banting (*Bos banteng* RAFFL.), specially the bull, is of a much more vigorous and heavy build, reaching a height at the shoulder of 1.60 m and with a total skull length of 50 - 55 cm, than the ordinary Bali cattle which is considered a practically pure banting breed. A Bali bull reaching a height of 1.30 m and having a skull length of 45 cm is a good specimen. So it need not occasion surprise if the recent tame buffalo is only a diminutive of its pleistocene and prehistoric ancestor, particularly as in Java and other islands of the Indian Archipelago there is hardly any selection and much inbreeding.

That under favourable circumstances the buffalo may develop into a much heavier animal is demonstrated by some specimens living in a semi-wild state. Well-known are the enormous horns of buffaloes in Sumba, the largest ones in possession of our Museum reaching nearly 3 m from tip to tip. Kopstein relates of the feral buffaloes occurring on Tenimber Island that they have got "ungeheure, dunkle Köpfe mit langen, schwarzen Haaren und mächtigen Hörnern, wie man sie beim javanischen Hausbüffel niemals sieht". These beasts could not be tamed and young individuals live only a short time in captivity.

As there is consequently no reason for repudiating the descent of the domesticated race from the form living in ancient times in Java the question arises whether there are still truly indigenous buffaloes living in Java, or elsewhere, and by which diagnostic features a wild form can be distinguished from a tame one. It is rather suprising to learn that these differences are nowhere clearly defined and that I was not able to get material of a really wild specimen. At my request at the Indian Museum at Calcutta for such material they told me that all the skulls in the said museum were of doubtful origin and obviously it could not be determined whether they originated from wild or tame specimens. The only skull of a so-called wild buffalo I saw was a specimen from Sarawak kindly lent for comparison by the Sarawak Museum.

However, some characteristics seem to be inherent to wild buffaloes, which does not mean that these are always absent in tame individuals. In the wild form the forehead should be flat and the profile line straight. The parietal region in lateral view is protruding as an extensive zone behind the horn core. The horns are in the same level as the front of the head or but slightly curved downward. A wild race is further characterized by the strong development of the grooves for the bloodvessels and nerves and the rough surface of the skull-bones (Cfr. Rütimeyer).

In tame specimens the front behind the orbita is often raised by the extension of the sinus frontalis, the horns are not seldom curved inwards and inclining downward and the surface of the skull-bones is mostly smooth. Thus, if a specimen exhibits some features opposed to those postulated as characteristic for a wild form, this argues evidently the influence of domestication. The reverse being the case it is, however, not so easy to decide whether we are dealing with a genuinely wild race.

Now I have examined five buffalo skulls, two from East-Java and three from South-Sumatra, of individuals shot from a herd living in a wild state. It is interesting to see how far these specimens show features proper to the wild form.

Of the first specimen, a bull, collected in South Banjoewangi, East-Java, in December 1916, only the frontal portion with horns has been preserved. The facial profile is straight, the horns in the same horizontal plane as the front, further, the strong rugosity of the supraorbitalia and frontal bones is very striking, but the grooves are less conspicuous. The horns are nicely curved in a semi-lunar form, very heavily built and broad, tapering rather rapidly

towards the tip (see Pl. 13). They are transversely sculptured by a number of broad and deep irregular grooves; the horns as well as the cores are flattened above, the frontal edges being very angular.

In many respects a skull without mandibles in possession of the Buitenzorg Museum (Coll. No. 758) agrees fairly well with the specimen referred to above. It was shot by the late Mr. TE MECHELEN at Vlakke Hoek at the extreme South-east point of Sumatra. Its characters are almost the same as in the Java specimen, the horns showing a similar shape and peculiarities, but the frontal breadth between the bases of the horns is large whereas it is extremely narrow in the skull from East-Java. It is also characterized by the strong rugosity of the frontal bones and the strong development of skull grooves (see Pl. 14).

From the same locality we have another specimen representing a younger animal (Coll. No. 759). Some features shown by this skull are certainly due to juvenile characters, e.g. the more rounded and less elongated form. In many other respects it approaches the other one from South-Sumatra, e.g. in the flat front, the angular horns and the deep skull grooves.

As already said we were able to compare these three skulls with one from Sarawak, a male individual shot at the mouth of the Baram river. This race is considered to be not domesticated or feral and has been given a special name (*Bos bubalis hosei* LYD.) on account of its smaller size and the relatively short horns. The type specimen has a white gorget on the throat and the lower part of the legs whitish.

The skull deviates from the Java and Sumatra specimens mentioned above by the markedly shorter and broader nasalia and the larger molar series. Above all the premolars are much heavier and broader, especially the lower ones, also the incisors are strikingly large. As to the horns these agree with the typical form found in the other "wild" specimens. The rugosity of the skull is less prominent.

Recently we received another specimen from South-Sumatra, collected by Mr. GROENEVELDT in Lais, Bencoolen. The skull aproximates the skulls from Vlakke Hoek but the "wild" characters are less striking and the horns are of poor form lacking the impressive broadness and fine massive shape being rather narrow and irregularly built, showing a constriction at a short distance from the base. The differences may be due partly to the specimen being a female.

The skin of the head of this specimen has been preserved. The general colour is rather dark, blackish above, the muzzle being whitish; inner sides of the ears adorned with long dirty white hairs. Underneath there is an elongated crescent-shaped whitish patch on the throat as described in *B.b. hosei,* and another similar but smaller and less conspicuous marking on the chin.

At our request a second specimen from the herd living in South Banjoewangi was shot by Mr. LEDEBOER and kindly presented by him to the Museum (Coll. No. 3219). This female shows in a far lesser degree "wild" characters than the male shot many years ago. Although the frontal line is straight and the surface of the bones surrounding the orbita and horn bases is rather rough, these features

are spoiled by the rather strong downward deflection of the horns, which decline so much that, when the skull (without mandibles) is resting on the molar-rows, the tips of the horns rest on the ground too and the occiput is raised 7.5 cm above the groundlevel. The horns are also less angular and more rounded a condition often observed in tame individuals.

Mr. LEDEBOER told us that the buffaloes of this herd are remarkable for their blackish colour and having a semi-lunar white patch on the breast. So

Skull measurements of wild(?) and tame buffaloes (in mm)

Locality	Saraw wild?	S. Sumatra wild?		Benc. wild?	E. Java wild?		Java tame	Sumb. tame
Btzg. Mus.	♂	♂	♂	♀	♂	♀	♂	♂
Coll. No.	—	758	759	3393	—	3219	3213	3220[1]
total length	468	533	474	492	510	522	503	512
basilar length	442	508	4[illegible]8	480	—	481	463	484
zygomatic breadth	196	214	207	198	217	219	207	213
greatest width	210	250	205	229	—	232	223	240
breadth below the horn pits	111	119	124	118	128	123	123	117
interorbital breadth	129	153	142	138	159	154	127	144
postorbital breadth	184	202	203	192	205	195	192	193
greatest breadth of rostrum	143	170	135	147	—	160	140	161
breadth of rostrum in front of infra-orb. canal	96	111	89	93	98	103	87	102
median length of nasals	166	203	196	190	201	201	209	204
gr. breadth of comb. nasals	60	68	52	58	67	61	50	60
palatal length	300	336	287	321	—	335	317	331
length upper molar series	145	139	—	142	—	132	135	128
length of m^3	31 5	31.0	—	28.2	—	31.2	28.0	28.2
breadth of m^3	21.9	25.1	—	20.6	—	24.5	21 9	25.0
length of lower molar series	159	—	—	158	—	149	150	138
length of m_3	39 6	—	—	35 1	—	38.7	37.4	38.7
breadth of m_3	16 3	—	—	15.3	—	18.3	16.8	17.0
breadth of i_1	23 7	—	—	19 0	—	15.3	—	13.8
breadth of i_2	23 1	—	—	18.8	—	13.7	17.7	14.1

[1]) castrated bull from Sumbawa.

Horn measurements

circumference of horn core	257	304	215	202	295	244	243	242
frontal breadth between horn cores	149	210	208	205	146	177	161	185
greatest length of horn core	325	451	283	322	425	390	286	387
tip-to-tip interval of horn cores	564	755	637	680	—	785	562	759
basal girth of horn	335	399	286	260	365	284	—	263
frontal breadth between horns	160	161	215	210	140	195	—	223
greatest length of horn	467	628	395	542	563	804	—	710
tip-to-tip interval of horns	547	702	759	763	773	690	—	605

we were very pleased when he also furnished the skin of the animal referred to above. But the colour is mainly ashy with a brownish tinge showing a prominent dorsal streak of long light tawny hairs; the head above dark brown, muzzle whitish; ears with long projecting whitish hairs. A white not clearly defined spot on the chin, the white patch on the throat very faintly indicated, another lunar spot on the breast somewhat obsolete. Forelegs brownish, underpart of the legs whitish from the knee and hock, with a peculiar $\perp$ -shaped dun coloured spot on the front a little above the hoof, on the forelegs this spot being less clear. Tail ending in a blackish tuft the tip with a number of white hairs. The wild Indian buffalo has also sometimes whitish legs but in tame forms this colour seems to occur more often and to reach to greater height.

From what has been said above and from the figures given in the table we may see that these so-called "wild" forms are far from being homogenous. Although they exhibit some "wild" characters it still remains a debatable point whether we are dealing with truly indigenous or with feral individuals. The herd in East-Java is certainly not pure bred: there must be some influx of tame blood. The herd of Vlakke Hoek seems for the moment to be the most purely wild one but this herd too is said to be descended from tame buffaloes abandoned after the coastal people had been swept away by the huge tidal wave following the eruption of Krakatau in 1883.

In many other places there are still buffaloes living in a semi-wild state viz. in South Bantam, and many other localities. These beasts are called "kerbau jalang" which means "deserted buffalo". Unless the animals are marked by incisions of the ears or perforation of the nasal septum they belong to no owner but are property of the community in the neighbourhood of which they occur. Adult feral individuals are seldom captured for they are difficult to tame and cannot be used for ploughing or as draught animals. Apart from these "kerbau jalang" the natives in Bencoolen also speak of "kerbau hutan" or jungle buffalo. But about the latter catagory, living far from human habitations, very little is known.

Before ending we should like to review some of the tales and other data extant with regard to the origin of the buffalo in Java and elsewhere.

In West-Java according to TEMMINCK there runs a tradition that the first Hindu king of Padjadjaran was the first who used the buffalo for ploughing. This monarch received thereafter the name of "mahesa" (javanese for buffalo) and his son was titled "moending" (sundanese for buffalo).

RÜTIMEYER's statement that the words "kerbau" and "moending" both mean "run wild" is not correct and apparently due to a misinterpretation of the dutch text by SCHLEGEL and MÜLLER (p. 207), where they say that both "kerbau djalang" and "moending djarah" mean "feral buffalo", i.e. djalang and djarah = feral. For the exact meaning of the words mahesa and moending quoted above I am indebted to Dr. Bos, Head of the Archaeological Survey in Batavia. The title "mahesa" of which moending is an equivalent, means literally "male buffalo" but in the sense of "his majesty". In these names the official Hindu

titles are combined with the ancient Indonesian totem names, both originating from the same fundamental idea "the leader of the herd".

According to another version the buffalo in the same period came over from the jungle to men of its own free will (SCHLEGEL). This latter version may be some evidence for the suggestion that wild buffaloes have been tamed by the old inhabitants. The period of the kingdom of Padjadjaran was formerly put in much earlier times but according to more recent investigations its foundation has to be fixed as late as the fifteenth century. But the tradition coupled to a well-known historical person may as well date back from a much earlier period. Anyhow the nucleus of the tale certainly refers to the time when the buffalo was first used by men either by copying from other people or by taming indigenous animals.

Another fact worth mentioning is that on the Borobudur, the famous Hindu temple in Central Java dating from the 9th century, buffaloes are also reproduced but in the very rare case when a plough is depicted it is drawn by zebus! (KARNY).

Yet the use of the buffalo without doubt originates from a much earlier date than the arrival of the Hindus in the Archipelago in the first centuries of the Christian era. This is clearly demonstrated by the indigenous terms and and names customary to the cultivation of irrigated rice. This cultivation with which the water-buffalo is so intimately connected was already known to the primitive Malay people living here long before the arrival of the Indians. Furthermore the many native names for the buffalo — almost every tribe and every island has its own name for this animal in contradistinction to the name for the ordinary cattle — are an indication of the ancient use of the animal or perhaps of its original occurrence. RÜTIMEYER's conclusion from the same fact of the taming of the buffalo having occurred at a much later date than that of the common ox is certainly not right. In this part of the world the domestication of the buffalo has to date back from far more remote times.

Anyhow we may conclude that the generally admitted theory of all buffaloes living in a state of nature in the islands of the Indian Archipelago being domesticated specimens run wild need not be accepted anymore without further investigation.

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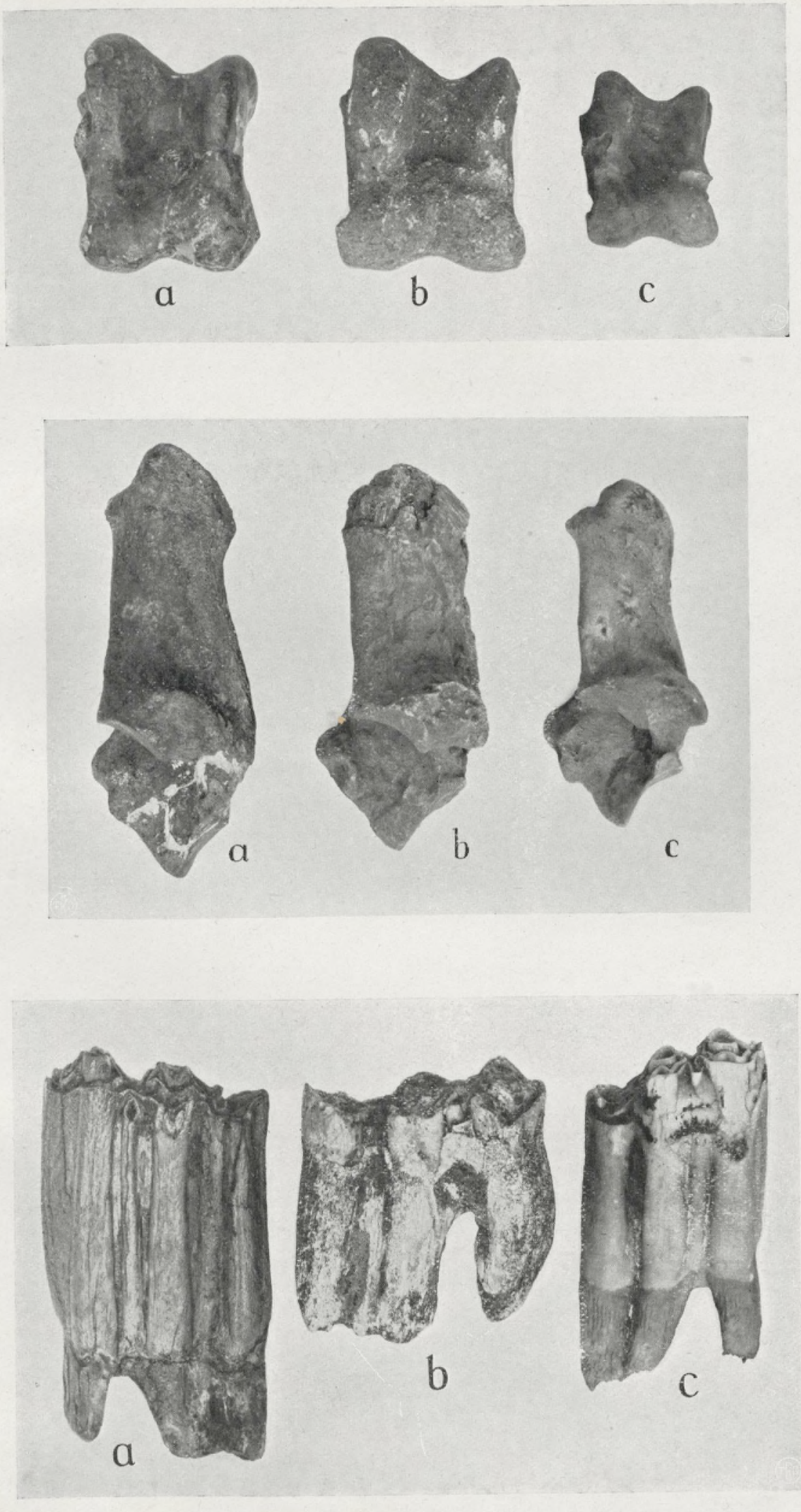
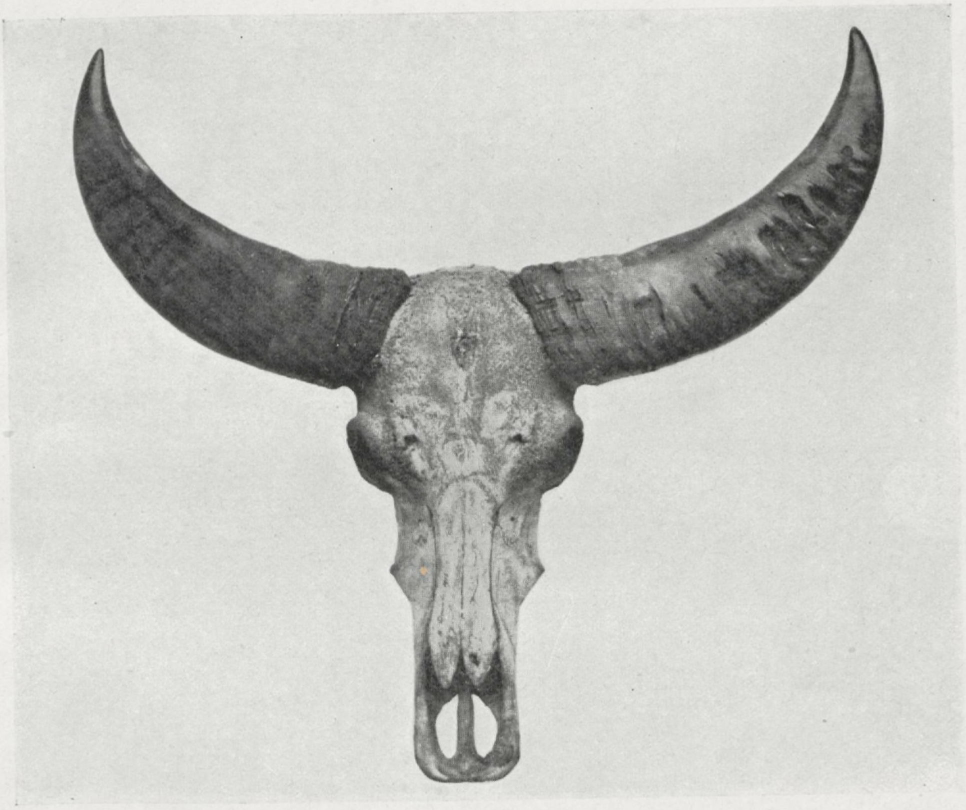


Bos bubalis. Top, astragali; middle, calcanea (⅓ nat. size); bottom, third lower molars (⅔ nat. size); a. fossil; b. prehistoric; c. recent.



Bos bubalis, Skull of wild(?) buffalo from E. Java.

Bos bubalis, skull of wild(?) buffalo from S. Sumatra.

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